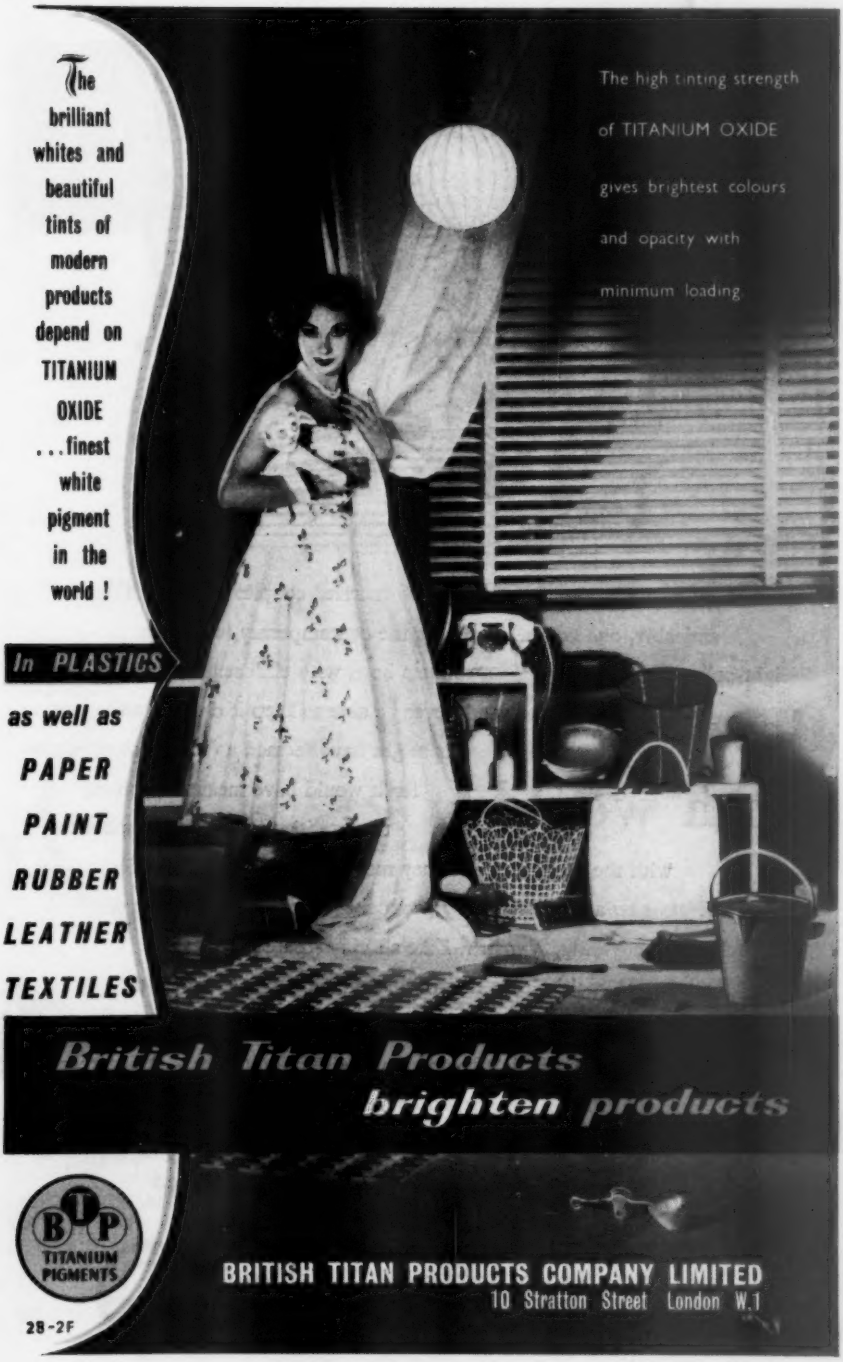
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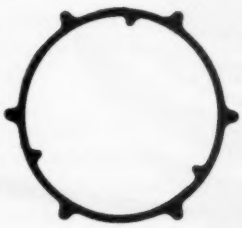
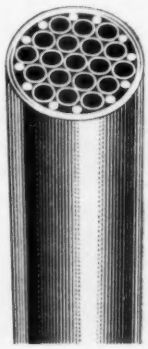
A stainless steel tube with external and internal ribs. The tube body is 1.650" o/d x .060" thick; the ribs are .093" high x .125" wide.





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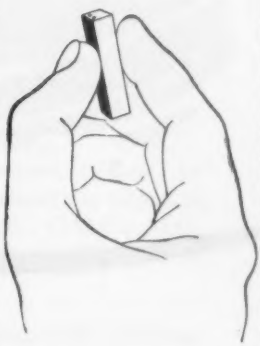
A square section tube in mild steel .25" A/F with two asymmetrical bores each .0625" diameter.



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TBW/218

ZERO

Zebra Continent

Africa is criss-crossed with zebras. Thousands of them,
from Khartoum to the Cape, lift their heads for a moment
as Fisons scientists pass by, walking, crawling on hands and knees,
driving or whirring along in helicopters. And year by year
African harvests increase in abundance and health.

Africa - it's all in **FISONS** field

Journal of the Royal Society of Arts

NO. 5022 MAY 1958 VOL. CVI

FORTHCOMING MEETINGS

MONDAY, 28TH APRIL, at 6 p.m. The last of three CANTOR LECTURES on '*Pre-stressed Concrete*', by G. W. Kirkland, M.B.E., M.I.C.E., M.I.Struct.E.

WEDNESDAY, 30TH APRIL, at 2.30 p.m. The second of three papers on '*British Trade*': '*Trade with the Commonwealth*', by G. S. Dunnett, C.M.G., O.B.E., Secretary, Commonwealth Economic Committee. Sir Patrick Hannon, Vice-President, Empire Industries Association, in the Chair.

WEDNESDAY, 7TH MAY, at 2.30 p.m. The last of three papers on '*British Trade*': '*Trade with Western Europe*', by Roger Falk, O.B.E., Managing Director, Marketing Development Co. Ltd., and Chairman, British Export Trade Research Organization (1952) Ltd. Major Sir Edward Beddington Behrens, C.M.G., M.C., Vice-Chairman, European League for Economic Co-operation, in the Chair.

THURSDAY, 8TH MAY, at 5.15 p.m. COMMONWEALTH SECTION. '*Ghana*', by His Excellency Edward O. Asafu-Adjaye, High Commissioner for Ghana in the United Kingdom. Sir Selwyn Selwyn-Clarke, K.B.E., C.M.G., M.C., Chairman, Commonwealth Section Committee, in the Chair. (Tea will be served in the Library from 4.30 p.m.)

WEDNESDAY, 14TH MAY, at 2.30 p.m. SIR WILLIAM JACKSON POPE MEMORIAL LECTURE. '*Expanding Horizons in Organic Chemistry*', by Professor Sir Ian Heilbron, D.S.O., F.R.S., Director of Research, Brewing Industry Research Foundation. Sir Eric Rideal, M.B.E., F.R.S., in the Chair.

THURSDAY, 22ND MAY, at 5.15 p.m. COMMONWEALTH SECTION. NEIL MATHESON MCWHARRIE LECTURE. '*Recent Developments in the Visual Arts in Canada*', by Alan Jarvis, B.A., Director, National Gallery of Canada. Sir Gordon Russell, C.B.E., R.D.I., Director, Council of Industrial Design, in the Chair. (Tea will be served in the Library from 4.30 p.m.)

WEDNESDAY, 28TH MAY, at 2.30 p.m. '*The Brussels Universal and International Exhibition*, 1958', by Charles Hadfield, C.M.G., Controller (Overseas), Central Office of Information, and United Kingdom Deputy Commissioner-General for the Brussels Exhibition. Sir Alfred Bossom, Bt., LL.D., F.R.I.B.A., J.P., M.P., Chairman of Council of the Society, in the Chair. (The paper will be illustrated.)

Fellows are entitled to attend any of the Society's meetings without tickets** (except where otherwise stated), **and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

CONFERENCE ON APPRENTICESHIP

The Council of the Society, on the recommendation of the Special Activities Committee, has decided to arrange a one-day Conference on apprenticeship at the Society's House, on Wednesday, 9th July, 1958.

The Conference will consider particularly two important subjects discussed in *Training for Skill*, the recently published Report by a Sub-Committee of the National Joint Advisory Council, viz., the problem of craft apprenticeship in the smaller firm and the need for closer co-operation between industry and education in apprenticeship training. Lord Nathan, who is President of the Association of Technical Institutions, has agreed to open the Conference and preside over its proceedings; and it is hoped that Mr. Robert Carr, M.P., late Parliamentary Secretary to the Ministry of Labour and National Service and Chairman of the Committee which produced the Report, will be among the speakers. It is expected that many organizations directly concerned with the subjects to be discussed will be represented, and it is intended to allow ample time for delegates to contribute their own experience and opinions.

A limited number of places will also be reserved for Fellows of the Society, and those who wish to attend should apply to the Deputy Secretary not later than 20th June.

EXHIBITION OF BURSARY DESIGNS

As announced in the last issue of the *Journal*, the exhibition of winning and commended designs in the 1957 Industrial Art Bursaries Competition will be held in the Society's House from Tuesday, 6th May, until Friday, 23rd June The exhibition will be open on Mondays to Fridays from 10 a.m. to 5.30 p.m., and on Saturdays from 10 a.m. to 12.30 p.m.

Special cards of admission will be required for the opening, which will be performed by Sir John Maud, G.C.B., C.B.E., at 12.15 p.m. on 6th May. It is expected that, although the majority of these cards must be issued to those who are directly concerned with the organization of the Competition, a number will also be available for other Fellows. Those Fellows who are interested should apply to the Secretary by 29th April.

THE SOCIETY'S CHRISTMAS CARD, 1958

The Society intends to produce another Christmas Card this year, and consideration is now being given to its form. Details of the design and cost will be announced in the *Journal* as soon as possible, so that orders may be placed in good time. Meanwhile, the present statement is made so that overseas Fellows, in particular, may have proper notice of the Society's intention.

MEETING OF COUNCIL

A meeting of Council was held on Monday, 14th April, 1958. Present: Sir Alfred Bossom (in the Chair); Dr. W. Greenhouse Allt; The Honble. G. C. H. Chubb; Mr. P. A. Le Neve Foster; Mr. John Gloag; Sir Ernest Goodale; Sir William Halcrow; Mr. A. C. Hartley; Lord Latham; Mr. Edgar Lawley; Mr. F. A. Mercer; Mr. O. P. Milne; Lord Nathan; Mr. A. R. N. Roberts; Professor R. D. Russell; Sir Selwyn Selwyn-Clarke; Sir Stephen Tallents; Professor S. Tolansky; Mr. G. E. Tonge; Mr. Hugh A. Warren; Sir Griffith Williams and Miss Anna Zinkeisen; with Dr. K. W. Luckhurst (Secretary); Mr. G. E. Mercer (Deputy Secretary) and Mr. J. S. Skidmore (Assistant Secretary).

ELECTIONS

The following candidates were duly elected Fellows of the Society:

Atkinson, Robert Ingham, A.R.I.B.A., Pudsey, Yorks.
Baker, Roger Bryan, N.D.D., London.
Baxter, Roland George, Dovercourt, Essex.
Bliss, Brig.-Gen. George L., New York, U.S.A.
Boniface, Raymond Cyril Charles, Basildon, Essex.
Bullock, Colonel Hugh, Hon.K.B.E., New York, U.S.A.
Carlton, Cedrick, A.T.D., Oxted, Surrey.
Chandler, Arthur Richard, F.L.C.M., London.
Chappell, Don Richard, Leeds.
Charlton, Frederick W., B.Com., Vancouver, B.C., Canada.
Covell, Ralph George Covington, F.R.I.B.A., London.
Doubleday, Ernest Harvey, O.B.E., PP.T.P.I., F.R.I.C.S., Hertford.
Godfrey, James William, London.
Harvey, Alan George, Gillingham, Kent.
Holden, Otto, B.A.Sc., C.E., D.Eng., Willowdale, Ontario, Canada.
Kingsbury, Henry Edmund Roland, Iver Heath, Bucks.
Knowles, Joshua Kenneth, C.B.E., Rickmansworth, Herts.
Mann, Professor Alfred K., B.A., M.S., Ph.D., Philadelphia, Pennsylvania, U.S.A.
Mayer, Adrian Curtis, B.A., Ph.D., London.
Maybury, William Henry, Folkestone, Kent.
McGregor-Cheers, Major Joseph, London.
Morris, William, A.R.I.B.A., Hemel Hempstead, Herts.
Murgatroyd, Keith, Marple, Cheshire.
Reheem, Chaudhuri Kemal, B.Sc., London.
Rochefort, Eric Bertram Albert, Folkestone, Kent.
Summers, Mrs. Josephine Ann, London.
Thomas, Iowerth Morlais, Harrow, Middx.
Worrall, Noel Richard, Birmingham.

The following were elected Associate Members as winners of Industrial Art Bursaries in 1957:

Baker, Robyn Richard, Ashford, Middx.
Barnes, John Eric, Peterborough, Northants.
Billing, Miss Patricia Frances, London.
Elliot, Miss Honor Julia, Sheffield.
Gibbs, Miss Patricia Veronica, London.
Johnson, Peter, Birmingham.
Lunn, Edward, Northampton.
Strange, John Brian Lionel, Beaconsfield, Bucks.
Tucker, John David Allan, High Wycombe, Bucks.
Tuffin, Miss Sally, North Romford, Essex.
Whitehead, Frederick Alan, Salford, Lancs.

The following were admitted as Institutions in Union:

The London Centre of the National Trust, London.
The Bermuda Technical Society, Hamilton, Bermuda.

NO. 18 ADAM STREET

It was reported that the British Association for the Advancement of Science was taking a lease, as the Society's sub-tenant, of accommodation at No. 18 Adam Street.

ALBERT MEDAL FOR 1958

Further consideration was given to the award of the Albert Medal for 1958.

NEW STAFF SUPERANNUATION SCHEME

Confirmation was given to the introduction, as from 1st April, of a new Staff Superannuation Scheme, and the Chairman of Council and Lord Nathan were chosen to be the Trustees appointed by the Society.

ALTERATIONS, DECORATIONS AND FURNISHINGS

Further consideration was given to alterations, decorations and furnishings in connection with the recent extension of the Society's premises.

EXAMINATIONS

It was reported that the number of entries received for the Whitsun series of Examinations was 52,994, an increase of 2,736 over the number of entries received in 1957.

OTHER BUSINESS

A quantity of financial and other business was transacted.

ERRATA

The address of Mr. S. C. Norrington, whose letter on 'Artificial Heels' was published on page 377 of the last issue of the *Journal*, is 70 Egmont Road, *Sutton* (*not* Surbiton), Surrey.

Mr. Walter J. Abel has written to point out that the question he asked of Dr. Gooding, in the discussion which followed the latter's paper on '*Modern Research into Bees and Bee-keeping*' (*Journal*, April, p. 321), began: 'Since the effect of feeding Royal Jelly to one of the cells produces a queen bee which is very much *superior* to anything else in the hive. . . '.

SETTING THE STAGE

A paper by

LAURENCE IRVING, O.B.E., R.D.I.,

read to the Society on Wednesday, 5th February, 1958, with John Clements, C.B.E., in the Chair

THE CHAIRMAN: I can think of no man better qualified to speak to us on 'Setting the Stage' than Mr. Laurence Irving, and if I may say so, very humbly, I can think of no man more qualified to know his value in setting the stage than myself. It has been my great privilege to have a number of my productions designed by Mr. Irving since I first launched out as an actor-manager in London some twelve years ago. The first play that he designed for me was Dryden's *Marriage à la Mode*, at the lamented St. James's Theatre in 1946. His settings for that play were, in my view, quite astonishing. There was the feeling of hot sun in deep shadow, of regal walks and behind them a shimmering, still sea. Then, in 1951, Mr. Irving designed *Man and Superman*. His settings for that—the drive in Richmond Park, the mountain scene in Granada and, above all, in the full version, the 'Hell' scene—were something that I shall always treasure. Then Mr. Irving did me a particular service for a play of my own, based on a French comedy, which I called *The Happy Marriage* and which he raised to a level which it in no way deserved by setting it in a superb scene overlooking the rooftops of London. Then there were Mr. Irving's settings for *Pygmalion*: and I am quite sure that the opening scene, particularly in Covent Garden, has never been so superbly done. Lastly, when I presented a season of classics at the Saville Theatre I asked him to design the first one, Ibsen's *The Wild Duck*; and here again he excelled himself.

But Mr. Irving's value to the theatre goes beyond designing. He is a member of the Council of the Stratford Memorial Theatre and of the Council of the Royal Academy of Dramatic Art. He is an author of many books and an illustrator of many more. Those of us in the theatre particularly cherish his superlative biography of his grandfather.

The following paper was then read:

THE PAPER

When I was honoured by the invitation of the Royal Society of Arts to read a paper on stage design, I suggested that a title more appropriate to the present situation of the English Theatre would be 'Setting the Stage'. The stage is said to be set when all is ready for a performance—scenery in place and correctly lit, properties to hand and actors ready, word perfect, to play their parts. The atmosphere before and behind the curtain is one of expectancy; once more the old miracle is to be performed. So it is to-day in the English Theatre. Aesthetic and economic developments are setting the stage with problems and challenges which only a transformation can resolve. The act drop has fallen promptly at the end of a theatrical century; with high hopes yet with certain misgivings we lean forward expectantly to see what it will reveal when it rises upon the new one.

I say theatrical century, for the significant centenaries of the English Theatre are out of step with the calendar by fifty years. Together Shakespeare and Burbage were the acme of the 1550–1650s, Betterton and Congreve of the 1650–1750s, Garrick and Sheridan of the 1750–1850s. In all these periods there were, of course, other remarkable actors and dramatists—but their names do not spring, as these others do, instantly to mind at the mere thought of their epoch. So, for as long as the record of the English Theatre runs, Irving and Shaw will, much to their surprise, share the honours of the 1850–1950s—a period rich in reform and experiment, opening rather shoddily and closing in an odd synthesis of intellectual pride, aesthetic doubt, and crippling economic stricture. Is it not then opportune, with a quizzing glass in one hand and a crystal ball in the other, to take stock of our present position and to assess the stresses and obstacles which those, particularly stage designers, likely to set their mark upon the approaching theatrical century will have to face?

Before I go any further I must, however, make a confession of faith. Though to me the design of scenery and the dressing of players is of absorbing interest and though much of my life has been spent in wooing this tinsel-clad Cinderella of the Muses, I must affirm that in my view the stage is at its best when the player is master of his own playhouse. During the past fifty years dramatists, scenic artists, producers and impresarios have contended furiously for the sovereignty of the stage. Some of them may be vain enough to imagine that for a brief, uneasy spell they have worn the crown. But this is an illusion, and for a very simple reason. Nobody but the actor or actress of genius or near-genius can draw the public to the playhouse and hold it there with the persistence that is necessary to economic survival. And, by the same token, nobody but the actor, with the audience-consciousness which is an element of his genius and is sharpened by experience, can order the many talents contributory to a stage performance with intuitive authority or can gauge the effect of their collaboration upon an audience; he alone can be master of the interplay of theatrical action and reaction. Several producers, such as Granville Barker, have held the stage for a time and have exerted a beneficial influence on the contemporary theatre; but they have neither won the hearts nor opened the purses of the public, and many of the best of them have learned what they knew of the stage as actors. No dramatist, Shakespeare included, can hold our attention with a mediocre cast or can hope for lasting reputation unless he provides material for a protagonist of genius. Scenic artists will be memorable in theatrical history only for the performances their settings have housed or for the quality of the actors they have dressed. The pre-eminence of the actor in the creation of drama was well expressed by that great Frenchman of the theatre, Louis Jouvet:

> The actor on stage has an eminent position, being instrument and instrumentalist, violin and virtuoso, playing himself and controlling himself, making his own music and intent for the echo of this music in the audience responding to his rhythm.

Because Jouvet seems to me to have come nearer to the ideal of the actor-*metteur-en-scène* than anyone else in our time, I shall probably quote him again.

If you will accept, or at least indulge this viewpoint, I should like in the brief time at our disposal to trace the emergence of the stage designer as a theatrical specialist, to outline the qualities that his task calls for at the present time and to forecast the challenge to the designer and to all his fellow workers for the stage which the aesthetic perplexities and economic hazards besetting the theatre to-day present.

The scenic artist has always been ready, standing in the wings, to lend his art to theatrical illusion. The moment the roof was put over the Blackfriars Theatre in 1597, the demand for his services by players and public was ever increasing. In order to refute at once the drab doctrine propounded by William Poel and others, namely that Shakespeare would have spurned scenic contrivance and that his plays need no such embellishment, I would remind you that those pioneers of the scenic art, Ben Jonson, Inigo Jones and Sir William Davenant, were near enough in taste and time to Shakespeare himself to reflect the aesthetic tendencies of the actor-poet and his theatrical colleagues, and that their enthusiastic experiments in the scenic art were not haunted or inhibited by any feelings of artistic guilt. Thereafter the scenic artist spread his wings in the para-theatrical masques and pageants of the French and English courts; when the theatre ceased to be a fanciful and glittering setting for the monarch who was at once spectator and spectacle, the artist was ready to provide realistic settings for the new-born democratic drama rooted in humanism. The beginning of the past theatrical century found his relation to the theatre unchanged except in his increasing mastery of the art of scene painting and stage device. Then the scenic designer and the scenic artist were one. He worked in close collaboration with the actor manager (Garrick and Lutherburg were typical of such an association). Usually he was a painter of distinction and, like Clarkson Stansfield, who served Macready, regarded the easel picture as his true métier—the proscenium arch offering him but a vaster canvas for the exercise of his art. Over the figures which moved before his panoramas and drop scenes he had little control; these were clothed by costumiers first in extravagant translations of contemporary fashion and later in dresses aiming at historical accuracy—only by accident did they harmonize with character and background.

In 1875 Edward Godwin, a versatile architect, was the first in this country to conceive the *mise-en-scène* as the work of one paramount designer. The Bancrofts gave him the chance to put his theories into practice at the old Prince of Wales Theatre. But the productions he designed failed to attract the attention they deserved. Why? Because the actors in them failed to attract the public. Irving, with Ellen Terry at his elbow, grasped the significance of Godwin's experiments and turned them to his own account. Working closely with accomplished scene painters of the old school and often with the help of Godwin himself, he created stage pictures which Charles Ricketts, himself a designer of great distinction and not over-partial to Irving as an actor, declared never since to have been equalled. They were, of course, stage pictures designed to enhance the moods which that great actor seems so inimitably to have created at the Lyceum—pictures which, in the manner of Rembrandt, drew the eye of the beholder to

the focus of the composition, the protagonist. Sometimes artists distinguished in other fields, Burne-Jones or Alma Tadema, were invited to collaborate in composing these pictures; though nothing was seen on the Lyceum stage that did not fulfil the intention of the actor-manager. So it might have gone on, with stage decoration fluctuating in style and excellence in accordance with the taste of the actors in command.

If we listen carefully we can hear, shortly after the turn of the century, the voice of one crying in a wilderness of realistic scene painting. In 1902 a young English architect, Edwin Lutyens, anticipated the scenic doctrine which was to gain so many converts among his own and later generations.

> My youth [he wrote] convinces me that the more real the scene is the better it must be in effect and that scenic conventions are a fraud; at all events, the real thing might want in force but it would not come forcibly wrong—and if slight it might form the better background and be less disturbing to a play. The necessary emphasis can be promoted by light.

In effect he foresaw that sooner or later light accenting three-dimensional surfaces would replace the artful illusion of form on canvas with distemper paints. Lutyens was not a man of the theatre and few heeded his remarks, but in 1904 the true interpretation of these and Godwin's theories were put before the public by Gordon Craig at the Imperial Theatre. Craig, the son of Godwin and Ellen Terry, had sharpened his instinct for the theatre as a member of Irving's Lyceum troupe. Parentage and environment endowed him with the gift of acting and with the vision of the artist. The latter prevailed, but the synthesis produced an *homme du théatre* of unprecedented capacity. There, in three productions, he revealed the power of simplicity in design and the dramatic force of light playing on architectural forms. Those who saw these productions (and there are several surviving and reliable witnesses) testify to the nobility of their conception, to their simplicity of effect and to their impact on a public conditioned to the rather stuffy splendours offered by the disciples of Irving. Again the public, insufficiently attracted by the players Craig had chosen for his début, failed to give the artist the support he needed—pardonably, if the views I have expressed are sound. Unpardonably, the leaders of the English stage—the actor-managers, the up and coming impresarios and fledgling producers—ignored the message so courageously delivered, or gave anæmic imitations of it without acknowledgement. Craig, having exhausted his own resources, was not invited by anyone in London to repeat the experiment. Whatever later critics may say, are we to be censorious if an artist of passionate conviction thus slighted, hardens his heart, wraps himself in a cloak of uncompromising integrity and withdraws to his tent in countries he believes to be more sympathetic to prophets of his calibre? Though England saw no more productions by Craig, his theories (largely through his lively and challenging publications) permeated the minds of all who dreamed of creating a theatre in tune with contemporary aesthetics, with the result that to-day no designer can or should put pencil to paper without breathing a short grace in acknowledgement of the clearer vision and livelier imagination which Craig's doctrines have kindled in him.

Though Craig's demonstration had little immediate influence on the contemporary stage, it speeded a schism in the scenic arts which was made inevitable by the appearance of the professional producer and by the decadence of scene painting. Playgoers whose wits had been sharpened by aesthetic adventures in other fields of art, began to weary of the conventions of realistic scene painting. They had been safe enough in the hands of a master *metteur-en-scène* who, against a realistic background, built up his stage compositions with a selective brush of roving limelight. But vulgar showmen and the drenching of the stage with light, which the new girl-and-music show was beginning to demand, had forced the scene painter to acquiesce in the tasteless exploitation of his art in order to keep his studios employed; thus he forfeited the respect of the more cultivated producers who were getting a foothold in the London theatre. When Granville Barker and his disciples sought the collaboration of easel picture painters of reputation, the enlistment of Norman Wilkinson, Charles Ricketts and George Sheringham hastened the ultimate and perhaps deplorable dichotomy of scenic artists and scenic designers. Abroad, Rheinhardt, with Ernst Stern at his side, was carrying neo-realistic décor to impressive extremes, while Diaghilev was collecting round him a group of painter-designers whose vast stage canvasses and exotic costumes were soon to enchant the capitals of Europe. The public applauded stage settings shorn of detail and dependent for their effect upon the clear statement of the designer. By the end of the First World War, which had wrought havoc in the debilitated English theatre, the designer had become a necessary contributor to any production of consequence. Unhappily the elimination of the actor-manager by those who saw that quick profits were to be made by exploiting the economic weakness of the theatrical profession and the vitiated taste of post-war theatre-goers, also put an end to continuity of policy in the theatre—that kind of continuity which had made it possible for Irving, Stanislavsky and Rheinhardt to perfect their methods and so to exert a lasting influence on stage practice. The actor-managers had certainly lagged behind the change in the intellectual outlook of their audiences, but they neither deserved nor were able to prevent the loss of authority in their own sphere which the acquisition of their theatres—in effect their workshops and their studios—by speculators entailed. These speculators were quite unconcerned with the state of the theatre except as a source of immediate profit, and felt none of the responsibility that was natural to the actor-managers for the welfare of their profession. The result was that in England theatrical artists and craftsmen had no established stages on which to work where experiment was welcome or possible. The producers were in no happier position. They too wandered from theatre to theatre at which their brief authority ended at the drop of the curtain on the first night. The only fruitful and persistent collaboration in the years between the wars was that between the producer Basil Dean and the designer George Harris under the patronage of Alec Rea. For several years a high standard of production was sustained at the St. Martin's Theatre, where Harris, with a stage at his disposal, developed new techniques in scene painting from which designers unconsciously benefit to-day. All this time, for better or worse, the

designer was called upon to fit his picture into the proscenium arch. But he was beginning to sense a restlessness which was infecting the theatre. Designers had already met the challenge of the continuous action which a film-conditioned audience began to demand. They found that if they could work closely with dramatists or producers intent upon the problem, the tedious intervals for scene changes could be avoided without limiting the range and variety of action which the public enjoyed and the theatre could still afford. But this did not stay the producers' urge for reforms. Instead of applying every modern resource to the improvement of the picture stage, they conducted tentative and rather tatty experiments in bringing the actor into closer contact with his audience, for the most part succeeding only in dispelling illusion and in time creating an audience who no longer felt, nor indeed could hardly imagine, the magic of great acting contained in evocative settings. One American actor, John Barrymore, gave us a glimpse of the splendid purposes to which the proscenium theatre could be put when he produced and played *Hamlet* at the Haymarket Theatre. First, he removed the proscenium pelmet and thereby entirely changed the proportion of its opening. To overcome the problems of lighting—dispensing as he did with the conventional borders and battens which normally dictate limits of height—he built great gantries framing the new sight lines from which batteries of arcs were able to reach, as required, every corner of this vast new acting area. This seemed to me to be the only time in this country when Craig's ideas (though he was not the designer) have been realized—unique as a bold scenic experiment. By changing the conventional letter-box or square aperture of the proscenium to one where height exceeded width, Barrymore had at his disposal a canvas of noble proportions so skilfully used that at no time was it disproportionate to the players themselves.

Meanwhile the designer had to reckon with two innovations which seemed to have come to stay—the revolving and apron stages. Both had their uses. In the hands of producers and designers who understood their limitations they could facilitate continuity of action. In foolish hands they could be vastly irritating and could defeat the actor's purpose. I have lived to see a production of *Romeo and Juliet* in which Juliet's bier was set on the apron stage. The final curtain fell behind it and in the inadequate blackout the dead lovers were seen to rise again and scuttle like frightened mice into the wings. The indiscriminating audience applauded loudly—they had not missed the emotions of which they had been robbed. The revolving stage, by its very nature, exactly halved the depth of stage available to the designer, though with skilful interlocking of two scenes set back to back on the circular revolving stage an illusion of greater depth could be achieved.

The success or failure of such innovations depended upon their theatrical fitness—in other words on the theatrical sense of those who employed them. The designer who was called upon to adjust his settings to these conditions, was at the mercy of the *metteur-en-scène*. He may have had to choose between the olympian integrity of Craig resulting in probable exile from the theatre, or having to acquiesce in contrivances which he knew to be a violation of theatrical

propriety. No theatrical convention is good or bad but its use or abuse makes it so. For instance, the closing years of this theatrical century have seen a vogue for changing scenery before the eyes of the audience: I do not mean by this scene shifting without a blackout, but the overt operation of the theatre's mechanical equipment or of devices inherent in the design of the setting. Now such effects, if artfully contrived, can add enormously to the gaiety and enchantment of comedy. Such has been the experience of those who saw the settings of Mariano for the Shakespeare Memorial Theatre production of *Much Ado*, Sir Laurence Olivier's witty production of *The School for Scandal* and *The Critic*, Jouvet's *L'Ecole des Femmes* and Mr. John Clements' robust presentation of *The Rivals* at the Saville Theatre. The delightful and ultimate comment on such devices was made by Mr. Peter Ustinov in his *Romanoff and Juliet*, when he, the protagonist, slapped a large unit of mobile scenery, which thereupon, like a faithful carthorse, trundled itself into a different position at his unspoken direction. Such amusing and challenging resources must be welcomed by designers concerned in comedy. In tragedy, where the creation of suspense and mood is the painful task of actor and dramatist, such tricks can be absolutely fatal. Where the aim of the actor is to hold his audience in thrall, distractions such as the disclosure of stage mechanisms destroy illusion and thereby break his spell. It is as inimical to the player's purpose to offend in this way as to rudely interrupt the trance of a patient under hypnosis. Unhappily, playgoers to-day are so rarely intoxicated by the magic of the theatre that they are unaware that they have been cheated of emotional experience. The pickpocket producers who thus rob them do so deliberately and boast of curbing the audience's emotional involvment in the play—calling their dreary dogma the theatre of alienation.

British designers have profited considerably from the unrestricted facilities given to foreign designers to work in this country. It is a pity that such artistic free trade is not reciprocal, for few English designers have been invited to work on productions in other European countries. The constant traffic of designers to and fro across the Atlantic has been immensely stimulating to their respective theatres. These, then, are the paths which have led stage designers to the position they hold in the theatre to-day and to define the theatrical climate in which they are at present working. What, you may ask, are the qualifications needed by a designer to justify his participation in the complex processes which go to the mounting of a play?

The scene designer must, of course, be a qualified graphic artist; that is to say, he must be capable of presenting his conceptions to his colleagues in visual form. It matters not if he is primarily an illustrator or an architect; it is important that he should have a flair for illustration and enough architectural training to enable him to undertake research intelligently and to present his plan to producers and technicians in intelligible form. These qualifications do not necessarily equip him to make his début as a stage designer; something more, an indefinable instinct for theatrical fitness, is needed which, like the art of composition in a painter, cannot be taught. He needs, in fact, the qualities which

Jouvet detected in the great French designer Christian Bérard—an instinct for elegance and a powerful dramatic sense. This latter sense becomes operative at the outset of his task, for it is that which enables him to read a play objectively. This sounds easy—but, in fact, the reading of a play with the mind's eye continually viewing it in terms of form and movement is a fairly rare talent. In my experience few dramatists, oddly enough, possess it, and one can be deceived by elaborate stage directions, such as Shaw and Barrie affected, into believing they have it when in fact they have not. Working for G. B. S., I found that he was often surprised into generous appreciation of designs for his films and plays which, to me, seemed to be a direct interpretation of his elaborate and imaginative directions. Many dramatists are quite unable to visualize the setting of their plays and not a few are indifferent to the quality of these settings as long as their practical needs are served. 'Men of letters', groaned Ricketts in a moment of exasperation during the production of a verse drama, 'have no taste!' I think he meant that they have no understanding of the contribution which the scenic artist can make to the success of their plays or of the practical difficulties the designer has to overcome. When author, actor and designer see eye to eye and enjoy enthusiastic collaboration, the play or film gains enormously and its production becomes exciting and deeply satisfying. But this is all too rare a conjunction. That is why it is essential that the designer must be able to read a play interpretatively so that, by his evident grasp of its mood and action, he can persuade all concerned in its production to accept his ideas in so far as they help and do not hinder their purpose.

Not long ago Professor R. D. Russell, in a paper which he read to your Society, laid down the axiom that quality in industrial design could be achieved only when the designer understood the processes of manufacture and marketing in the industry for which he was working. While denying absolutely that the theatre is an industry and affirming that in so far as it has become one it is to its great detriment, I would say that quality in the design of stage productions depends just as much on the designer being familiar with the skills and problems of all who help him to realize his project. These craftsmen and mechanics on whom he must depend make a formidable list. After the actor, dramatist and producer with whom he has been concerned in the planning stage, the following have a right to his sympathetic understanding of their methods and technique: stage carpenters, scene painters, dressmakers, property masters, stage managers (on whom, with the stage hands, the efficient changing of scenery depends), electricians, property men, and, of course, the cast of actors and actresses. Long as this list seems, it is not much longer than that of the trades with which an architect must be familiar when he builds a house. But it suffices to show that designing for the stage is not a playground for the dilettante, nor even for a professional artist who is content to let these skilled craftsmen lick an amorphous design into a shape for which he ultimately will take the credit.

Before even accepting a commission or reading a play, the designer must master the general principle of theatre construction. For the teasing lines of sight—upwards from the stalls, downwards from the upper circles and wingwards

from the extremities of the circles and boxes—will dictate the limits of his setting. This is the counsel of perfection; however carefully his plans may be made in this respect, in practice they may be confounded by circumstances outside his control. For, in the haphazard method of the English theatre to-day, he may not even know the theatre for which his play is destined and thus be ignorant of the dimensions vital to its most advantageous mounting. Even if he does, he may find that in the ignoble process prevalent to-day of trying out London productions on the provincial dog, his sets must be capable of expansion or contraction to fit into proscenium openings which may vary in width from 28 feet to 40 feet.

With practice he will become familiar with the normal structural resources, such as rostrums and mobile trucks, and he will soon develop an instinct for what is possible in the way of unit construction and other devices for facilitating quick changes. But if he is wise he will engage the co-operation and advice of the stage carpenters, for in them is deposited centuries of traditional know-how. In Jouvet's production of *Le Corsair* at the Athénée Theatre, a large desk at which an American film executive played a short scene was whisked magically from sight—an effect so extraordinary that a seasoned playgoer asked Jouvet to disclose the secret of its disappearance. 'When', replied the actor, 'one has worked with the same stage carpenter for 27 years, nothing is impossible.'

In order to mitigate the schism between designer and scene painter, to which I have referred, tact and a firm grasp of scene painting technique, coupled with precision and clarity in conveying his intentions, will be needed by the designer to justify the whole-hearted contribution of the skill of the scenic artist. That master of stage design and *trompe d'oeil* decoration, Rex Whistler, was ever considerate of his scenic artists—ready to take his stand at the painting frames and to make the first essay of a decorative motif or an architectural moulding for their guidance.

Again, like the stage carpenter, the theatrical costumier has a fund of peculiar knowledge on which the wise designer will be ready to draw. Down the centuries stage dressmakers have acquired a rich store of tricks and expediences—above all a knowledge of what in fabrics or fabrication is necessary to achieve a theatrical effect. Often, too, the designer may have to humour players who, on putting on a completed costume, become so paralysed as to look no more than dressed up lay figures—seeming like wilful children to stiffen stubbornly and to lose for the moment all sense of the characters they have laboured to create—in fact, to occupy their clothes rather than to wear them with a flourish. This was more common in the dog days between the decline of romantic drama, with the training in deportment it imposed on apprentice players, and the present establishment of schools of acting and of such universities as the Shakespeare Memorial Theatre and the Old Vic as now provide this necessary experience for the student actor. Nevertheless, tact and a readiness to appreciate the players' needs and difficulties is essential; it is even better to try to quicken their enthusiasm and co-operation by showing them, even before rehearsals begin, a drawing which illustrates, in all respects, the characters they are to portray.

In fact, the designer worthy of theatrical reputationis one who, studying prevailing practices with humble diligence, himself adds in however small a degree something to the age-old sorcery of make-believe.

When his scenes are set and the players stand ready in his costumes, these have no meaning until the electrician illumines them. The electrician, after the players, bears perhaps the greatest responsibility in a modern theatre. His apparatus is complex, his use of it demands absolute precision and an instinct for its dramatic purpose. The designer, therefore, when making his drawings should bear the electrician and his equipment ever in mind. In America this is so well understood that leading designers such as Lee Simonson and Mieltziner, having worked out the action of the play with the dramatist at an earlier stage, furnish with their plans a lighting plot which will sometimes include the invention of new mechanical devices. I am afraid that at present, if such thorough approach to his work was suggested by a scene designer in this country, he would be found guilty of almost lunatic and certainly misguided enthusiasm.

Samuel Butler wrote that a man's style in any art should be like his dress; it should attract as little attention as possible. This is certainly true of the scenic artist. To some extent, each play he works upon will dictate a style of its own. The worst aesthetic sin he can commit is to exploit his own virtuosity at the expense of the play or of the players he is supposed to be serving. His task is to aim at perfection in terms of the occasion. A recent exhibition of designs for the ballet illustrated perfectly the damage that the vanity of artists can inflict upon an all too vulnerable theatrical art form. Within Diaghilev's time and, I am afraid, often with his encouragement (for he became increasingly vulnerable to fashionable and meretricious influences), designers came to think more of the acclaim their sketches might win in books and exhibitions than of their purpose as working drawings for the guidance of technicians or as complements to the music and choreography they were supposed to enhance. It needed no great critical faculty to observe that, whereas the designs of Alexandre Benois, from the beginning to the present phase of his long and brilliant career, were realized completely in the photographs of the scenery and costumes derived from his drawings, his successors tended more and more to produce facile sketches which on photographic evidence were incapable of effective realization. The work of Rex Whistler (whose production of *Victoria Regina* was, perhaps, the most beautiful and accomplished of our time), was remarkable for his adaptability of style, his designs for such widely disparate subjects as *Pride and Prejudice* and *Fidelio* having no common denominator but the perfection of their execution and their theatrical fitness. Those who have been lucky enough to see Mr. Oliver Messel's productions of *Helen*, *The Sleeping Princess* and *The Dark is Light Enough* will see in them the response of a self-effacing designer to the demands of wit, romance and dramatic force—his signature traceable only in the uniformity of the elegance and invention inherent in any task to which he sets his hand. Only a mountebank painter turning to scenic design would be gratified by the applause of an audience recognizing, on the rise of the curtain, his stylish hand in the setting of a play or ballet—such immediate association of stage imagery

with an extra-theatrical reputation or performance delaying the surrender of the audience to the impact of the play. Indeed, British designers should be ever on guard against stylish affectation and should aim, as Charles Ricketts shrewdly observed, to produce work 'free from fluff and something small and mincing as we always have in England'. In short, style may be the man in literature but it can be the very devil in an insubordinate stage designer, who can too easily upset the delicate equilibrium of collaboration on which theatrical production depends.

I referred earlier to a mood of restlessness and doubt that pervades the Western theatre at this time. This discontent and rebelliousness often find expression in criticism of the very nature of the theatre to which we are accustomed—one presenting an illusion of reality framed in a proscenium arch. Accepted conventions, evolved by men of the theatre through centuries of trial and error, are suspect both as an impediment to effective communion between players and playgoers and as limiting the social and aesthetic influence of the drama necessary to our present and future cultural development. This mood of readjustment and of chafing at real or imagined restrictions is not as wholesome as it might seem. It can be a symptom of decadence in the arts of play-writing and play-acting. The workmen of the theatre may think that they are sharpening their tools for a more incisive method of dramatic communication when in fact these have been blunted by their own incapacity. They rummage desperately in antiquity for remedies of present ills and formulate palliatives on mythical and often sentimental assumptions. Take, for instance, their pre-occupation with the theatre as a social force. Disregarding the fact that eighty years ago the theatre commanded attentive audiences in every city of the United Kingdom, *now*, when so many theatres have vanished, when many more are threatened with demolition and when the hard-won audiences that filled them have dispersed, they persuade themselves that it is the material form of the theatre and not the spiritual decline of the theatricals which is to blame. Advocates of new theatre forms look over their shoulders for inspiration, seeking what they may derive from the municipal drama of Athens or from the makeshift arrangements of the Elizabethan playhouse. Not surprisingly, when the avant-garde advances looking backwards it often falls flat on its face.

If a remedy is sought for the infirmities of the English Theatre to-day it is not to be found in sham archaism. The size and shape of our present theatre, at its best, has been evolved over centuries to match the optimum range over which an accomplished actor can make himself heard and exert his magnetism. Before the proscenium, our theatrical forebears calculated with extraordinary precision the area of the magnetic field which a dynamic player could activate; behind it, they had evolved the proportions and mechanical resources of the stage capable of accommodating an almost limitless range of scenic effects—the Theatre Royal, Drury Lane, being still a perfect example of this evolution. The actor's aim is to cast his spell over the individual. If he wins an ovation, it is the chorus of individual intellects that gives savour to the applause. It is the demagogue, not the actor, who seeks to play on mass emotions. Civilization

is surely the emancipation of the individual from the domination of mass emotion. The theatre can have no greater significance than that of each individual member of the audience entering into possession of the mood or illusion that the players and their fellow artists try to create. The heresy prevalent to-day is that anyone in the theatre other than the actor can so possess an audience; the graphic, literary and musical arts, and even the intangible art of the producer, have their place in the theatre, but it is the actor alone who can compel the playgoer's attention and win his applause. It was to meet the actor's requirement that most of our theatres were designed in their present form—indeed, most of the theatres in England were in fact built by actors for their own use.

If I have dwelt over-long on this theme, it is because its inherent dangers are immediate. Existing theatres are crumbling around us—no longer able to sustain the economic burden of the value of the ground on which they stand. Sooner or later public demand will lead to the building of new ones. It is not impossible, now that the actor has lost economic control of the stage, that these theatres will be built by investors who, thinking only of potential receipts, over-estimate the capacity of the actor's power over his audience. Already two or three London theatres bear witness to this folly; with auditoria so ill-contrived in relation to their stages that, however the actor may exert himself, his hold upon the audience is tenuous, his nuances of speech and action evaporating as they venture into the acoustic void. On the other hand, an enlightened Government may, before long, provide the means for building State and municipal theatres. But the earnest purveyors of State patronage are as liable to error as the men of commerce. How little they regard the needs of the actor was evident when at the laying of the foundation stone of the National Theatre not a single player was to be seen among the officiates. So our State theatres may be built by enthusiastic amateurs ignorant of the requirements needed to promote what a great French actor has called 'the unity of actor, author and audience; the mystical force which endows the actor with hypnotic powers, bringing his acting to a fine edge'. We may find ourselves saddled with theatres in which the actor is incapable of giving us the emotional experience which we crave. What do I mean by this? I mean performances that inspire playgoers to leave flowers on the grave of an actor fifty years after his death in thanks for what they received from him; I mean the magnetic force that drew the adolescent Jouvet forty times to see Mounet Sully's Oedipus; I mean the intoxication which caused Charles Ricketts, as he told me, after the first revelation of the Russian Ballet 'to walk all the way to Holland Park in my pumps'.

And if for these reasons the actor's art is in jeopardy, how much more so the art of the scene designer! Just as splendid electrical and mechanical resources are at hand to give scope to his invention, just as methods and control of lighting are suggesting fascinating possibilities, conditions are being created in which he will find it difficult to arrange for more than the most perfunctory effects. It is, of course, possible that the object of these reforms is to dispense with the scenic artist altogether. If so, it is, I think, unlikely to succeed. For in the end the public will assert their taste for glimpses of the world of the imagination, for

visions which can transport them from the cares and materialism of modern life.

Nobody, however, should imagine that the theatre is on its last legs. It is never so, and at the moment has a greater wealth of young and promising talents than ever before. But if not on its last legs, it is indisputably in the wrong hands; wrong, that is, if the requirements and accommodation of the artists working in it should conform to those enjoyed by workers in the sister Arts. Lately there has been much talk in literary circles about the writer's commitment to his task. Commitment is of course desirable in all artists. Established in his study, studio, or (if he is an architect) in his office, the artist need fear no physical obstruction to his commitment. No less do artists in the theatre need premises inducive to their commitment. But, at the moment, these premises are denied them—they can occupy them only for the uncertain tenancy the run of a play affords. It is a paradox that, though the actor through centuries of autocratic government and social insecurity retained possession of his theatre, in these days of economic and social reform he has been dispossessed by financial and intellectual busybodies convinced that he is incapable of minding his own business.

It may be argued that the actor, like everyone else must take his chance in the economic rough and tumble. But the consequences of his dispossession are far more serious than is generally supposed. A few weeks ago one of our younger critics, content enough with existing conditions, deplored the absence of what he called actors of weight. He seemed to imagine that an actor, if nourished on a diet of fat parts, could put on this weight like a prize-fighter. What this critic called weight is, of course, the quality that an actor derives from the exercise of command—command of his art, command of his audience, command of his theatre, and of the company he directs and leads. Independence and authority are the necessary components of his stature as an artist.

It was probably this quality in Burbage which drew from a supporting actor in his troupe such a steady flow of transcendent dramatic material.

Of course the actor, like all of us, is subject to human weaknesses and capable of gross error. But I contend that those faults to which he is most vulnerable—vanity, egotism and intellectual sloth—are less of a danger to the health of the theatre than the irresponsibility, the desire for power and the intellectual pride of those who seek to displace him.

The rhythm of the English theatre tends to be messianic. Periodically it falls into lethargy or into frantic vulgarity, responding to the popular mood rather than aiming to inspire it. Then from some unlikely quarter comes an actor or dramatist of genius, to which genius is allied force of character enabling him to establish a standard of excellence by which contemporary theatrical achievement must be measured. Without giants as exemplars any art tends to fall into anarchy. It is not an accident that music has suffered less in our time from disarray and distraction than her sister arts. For among us in times of doubt and stress two undisputed masters, Sibelius and Dr. Vaughan Williams, have by their happy longevity been a living challenge to the second-rate—heights of accomplishment to whom disciples on the plains can turn their eyes, whose integrity in the face of common worldly experience cannot be denied.

It is unlikely that the actor can be restored to pre-eminence in the theatre without State or municipal intervention. For only by statute can theatres be provided for his occupation at a rental representing no more than the interest on their capital investment and the cost of their maintenance and servicing. Until now the purveyors of official patronage have seemed reluctant to come to the aid of individual theatrical artists—preferring to nourish an organization rather than a genius, to subsidize repertory companies rather than to reinforce a young actor ambitious to take the field with his own company. I suggest, therefore, that they read again Lord Keynes's original draft of the aims and objects of the Arts Council:

> Everyone [he wrote] recognizes that the work of the artist in all its aspects is, of its nature, individual and free, undisciplined, unregimented, uncontrolled. The artist walks where the breath of the spirit blows him. He cannot be told his direction, he does not know it himself. But he leads the rest of us into fresh pastures and teaches us to love and to enjoy what we often begin by rejecting, enlarging our sensibility and purifying our instincts. The task of the official body is not to teach or to censor, but to give courage, confidence and opportunity. Artists depend on the world they live in and the spirit of the age.

Such was Lord Keynes's purpose. The actor is the supreme artist of the theatre. It is he to whom, in these days, the State should strive to give courage, confidence and opportunity. That he will reassert his pre-eminence is in the light of history almost certain. His next manifestation will be enhanced by intellectual powers with which an education, undreamed of by his predecessors, will have endowed him. If he finds at his side a dramatist of equal stature sharing these intellectual advantages, the stage of the coming century will be well and truly set. And scenic artists, in company with all who may serve an exemplary theatre to which we may look forward, can be assured of inspiration, of opportunities for self expression and, with the skills that modern facilities for training now provide, of the ability to subscribe to another illustrious page in the history of English Dramatic Art.

DISCUSSION

MR. F. C. WINBY: Many years ago I saw the grandfather of our lecturer act. I should like to ask what influence the setting has on the actor, because when I saw Henry Irving act I did not notice anything, except him.

THE CHAIRMAN: Mr. Irving says that I should answer that! What effect has the setting on the actor? It has the most profound effect, and it works in one of two ways. Either the setting can fit or it cannot fit—it can be a frame and a help to the actor in its atmosphere, its rightness, its fitness to the play, or it can be a hindrance for the opposite reason. As Mr. Irving has said, the scenic artist of real quality is the man who fits his set to the play, to his actors and, indeed, to his audience, so that it shall not be noticed separately but recognized as part of a right whole.

MR. LIONEL BRITTON: I should like to disagree with Mr. Irving in the stress he laid upon the importance of the actor. This is universal, as one can see from any advertisements of any plays, but it is this which is leading to the decay of the theatre. It is the dramatist, not the actor, who must come first, if the theatre is to live. Without

the dramatist there is no actor, there is no scene designer, there is no theatre. But a dramatist who tries to advance the theatre is met with a reaction, when he offers a play to a manager, which has no understanding of the theatre, beyond what an actor can do, and only by accident any understanding of the powers and resources of the stage. There was a play by Stephen King-Hall in Shaftesbury Avenue called *B.J.1* (a destroyer), which put on the stage a battle in the North Sea at night. Such a play could be produced nowadays only by accident, by some accidental contact between author and manager and producer before the play is offered; and if a manager reads such a play, out of the blue, from the point of view of the actor, he will say the author is a fool who knows nothing about the stage. A battle in the North Sea at night, on the stage! It cannot be done! But it was done. The producer, Reginald Bach, hung the stage in black velvet, turned off all the lights, and shone a film of a battle at sea (which he borrowed from the Admiralty) on the black velvet, and the black velvet reflected just enough light to show a battle at night. But if you cannot write for such effects, if those who read your plays, for the managers, know nothing about the theatre except the actor, if they think that all a play is for is to show the actor, how is the theatre to advance ? All the stress in the theatre now is laid on cost, so that sets must be reduced and plays made more monotonous: but you can change a set with the click of a switch, by painting it in complementary colours and using complementary lights, so that with one set of lights one scene appears and another disappears, and you can have variety and change to compete with the film, costing nothing. Critics do not appear to know these things in their reviews, which stress the actor; nor do the managers, and unfortunately, with all this discouragement, nor do the dramatists, and the theatre is in decay, and something high and fine and tremendous will presently go out of life, and leave life the darker for it.

MR. ALFRED EMMET: As I understood him, Mr. Irving's view is that there is no future for any theatre other than a picture-frame theatre, and that there is no future for what he somewhat loosely and perhaps a little bit mystically described as 'new forms'. Does he not consider it significant that the one new theatre which he pointed out is now being created by an actor (I mean the Mermaid Theatre) is an open stage theatre without a frame ?

THE LECTURER: I meant to imply that nobody but the actor is really qualified to indulge in any new theatrical art form. There may be actors who find themselves very much at home in a replica of an Elizabethan theatre, as Mr. Bernard Miles did. He made all sorts of fascinating discoveries about dramatic technique as a result. The danger is, I think, that (with the exception of Mr. Miles) many actors using these apron stages overestimate their own dynamics. It cannot really be a matter of individuals, it must be a matter of traditional development. I think that an architect who is building a new theatre would be better advised to stick close to actors and seek their technical opinions.

MR. JOHN FERNALD (Principal, Royal Academy of Dramatic Art): The lecturer made three points which particularly interested me. The first was in regard to shifting scenery in view of the audience, which he said was an interesting and amusing method when applied to comedy but could be dangerous when applied to tragedy. Would the lecturer agree that the challenge should be taken up where it is held by a producer that speed is essential to continuity of effect? Is it not then a duty of the producer and the designer to make a dramatic virtue of this visual shifting so that it actually helps the actor ? And would Mr. Irving agree that perhaps Mr. Peter Brook in his production of *Titus Andronicus* met that challenge in the capacities of both designer and producer?

Secondly, I was rather surprised that Mr. Irving said that the shape of the English theatre as evolved through the ages was more or less an ideal one—or did

I misunderstand him? I should have thought that the shape of the theatre in this country has evolved as a result of economic necessity, and has been determined by the need for cramming the largest possible number of seats into a small space. For that reason I would say the majority of our conventional theatres were poor from the point of view of design and vastly inferior to those we find on the Continent, where the theatres are on the whole horseshoe-shaped rather than fan-shaped.

Finally, with regard to the additional senses of the dramatist: did I understand the lecturer to say that Shaw's visual sense was deficient? That Shaw's directions could not be put into practical effect? Perhaps I misunderstood; but if there is one dramatist whose stage directions cannot be improved upon it is Shaw's. You get into very difficult water indeed if you try to muffle them; if you follow them you find that they work out very well.

THE LECTURER: If I may answer your last point first: no, I did not imply that G.B.S. had no visual sense. What he had to a greater degree than any dramatist I ever worked with (particularly when coming to make a film) was enthusiasm. He was willing to do anything to transfer his plays into another medium. What I did find with Shaw was that where I faithfully, as I thought, tried to draw what he wrote, I often was astonished by his surprise and pleasure in what he saw; which suggested that though he had written this description he had not really any highly developed visual sense. They are two very different things. If you visit Shaw's house at Ayot St. Lawrence you will see what I mean.

With all respect, I think the actor is the best judge of what constitutes the ideal theatre, because it is he who has to regain what the manipulation of machinery in front of the audience inevitably destroys. I well remember a production of *Macbeth* at Stratford on Avon. There were Duncan and the bleeding sergeant on the stage—and quite suddenly the camp went up into the flies and down came Dunsinane. Now surely it would have been better to have had no scenery at all, because the important thing at this point of the play is to persuade the audience of the ominous approach of Duncan's death, and I think contact with the audience was lost really before he was dead. The responsibility for sustaining an effect falls on the actor. None of the rest of us has to stand night after night on the stage and win the applause of the audience. We can try all sorts of tricks, but it is slightly irresponsible if we are leaving the actor alone to carry them through to a successful conclusion every night.

I think Mr. Fernald is perfectly right about the traditional theatre. The American theatres have certainly improved the audience's position. Whether or not they have improved the actor's position is another matter. But I still stick to my point that probably the most perfect theatre in the world from everybody's point of view—from the call boy upwards to the man in the gallery—is the Theatre Royal, Drury Lane; anyone who has worked there would accept that. But of course, Drury Lane has improved on the theatre one hundred years before it. My point is that at present even in discussion the actor is not consulted as to how his theatre is to be built.

MR. HEINZ BERNARD: If any of the various artists who make up the art of the theatre has to predominate, I agree that it should be the actor. But would Mr. Irving not also agree that collaboration between the actor, the dramatist, the designer, the musician, and so forth, is better than a complete dominance by the actor? I am thinking of his rather slighting reference to 'pick-pocket producers', by which he meant, I believe, the theatre of Brecht and his followers. It seems to many of us that in that theatre there is a greater synthesis of poetry, acting, music and design, than in any theatre of our own time, and that that kind of theatre is closer to the spirit of our time than the theatre in which the actor alone predominates. Incidentally, it is in the theatre of Brecht that the designer has achieved a unique position. It is the one theatre where the designer does not only design the set and the costume (in the

English theatre he does not always do both), but also places the actors in the relationship which he feels they should occupy in his design.

In conclusion, may I ask if Mr. Irving has ever sat in the gallery of the Theatre Royal, Drury Lane?

THE LECTURER: Yes, of course I have. No designer worthy of his task would ever be satisfied with his designs until he had looked at them from the gallery; and many designers go to great pains to see that the pattern of the floor on which the play is performed makes in itself an interesting setting for the people moving on it. You remember there was a ballet, *Checkmate*, which took place entirely on a chessboard: you can do a great deal to enhance motive by simply working on the shape of the floor. A conscientious designer always goes to the extremities of the house to see the result of his work.

About the other point, I am not quite clear. I have an idea that Brecht was at one time an actor, is that so?

MR. FERNALD: Yes, he did act.

THE LECTURER: Certainly his wife was a great actress, and this takes me back to where I began: that there is no happier collaboration in the theatre than under the direction of the player.

MR. ROGER ANDREWS: Does Mr. Irving consider that a young person is going to spend quite a long time training as an architect or (as Mr. Irving suggested) an illustrator, and then be prepared to sit around in a studio in London waiting; hoping that some management will give him the opportunity to design a set for one of their West End productions, or perhaps for Glyndebourne or Stratford? Does Mr. Irving not feel that at the present time there are too many plays which can be set perfectly easily by a furniture store without any further assistance from a designer, and that if a play is worthy of the best set, Mr. Peter Brook with the aid of his expert electricians can look after it very well—whilst the poor young designer (not any of the old fogies, if you will forgive me) is not going to get a look in? The young designer will in fact surely turn to television, for there is at least some hope that thereby he will make a living. Does Mr. Irving agree that designers are going to turn to television for work, and that the theatre is going to get its settings from the people like those I have just mentioned?

THE LECTURER: This is a question I can only really answer from my own experience, and from the experience of people who come to me as assistants (and although they are not quite old fogies yet, they are getting on that way, and I would remind you that even the oldest of fogies like myself was once a young designer!) There are a lot of students here to-day—and I should like to offer them one word of warning. It is no good any artist who has been to any kind of art school sitting down on the ruins of his happiness and expecting any particular form of work to come his way; he has got to go out and find it. When I was a young man I took on any kind of work I could get, illustration or anything else, and it was probably through this different work that someone asked me to do a play, and through that somebody asked me to do a film and back again to something else. Don't specialize. The other day I saw a rather disparaging reference to an artist as having been a poster designer. Well, I think that Augustus John has been a poster designer. Certainly William Nicholson was, certainly Rex Whistler would have turned his hand to anything. And it is out of this readiness to tackle anything, I think, that the ability to design for the stage comes, plus this faculty I have mentioned, which I do not think you can learn in school, a feeling for the drama. If you study in the section of an art school concerned with stage design, don't think at the end of the day, when you have made some models or knocked up some properties or dresses, that your work has finished. It has not

really begun. In your spare time you should be reading avidly all you can, especially plays, designing them in your mind's eye and of course going to see them as often as possible.

On the other hand, I think there were never such chances for young people as there are to-day. Everybody is looking out for new talent. Every year at Stratford at least two or three of the productions are designed by artists who have never done that kind of work before. Do not despair, the old fogies are getting out of the way as quickly as they can.

MR. T. ROSEDALE: Mr. Irving emphasized the importance of the actor; but there were a great number of very fine productions at Drury Lane which depended almost entirely for their success on the scenery. The old melodramas such as *The Whip* and plays of that kind involved a great deal of mechanical change, and I would say that quite a number of people could not remember what actors were in them. May I also suggest that mechanical changes in sight are, or should be, a good thing? I can remember one of the Drury Lane dramas in which there was a most beautiful scene at a quayside. The audience apparently saw the ship leave the quay and go out into the open sea—a beautiful piece of stagecraft. That is a change in sight, a mechanical change, really clever and most convincing. Has Mr. Irving anything further to say on that? I would also ask him to stress to young designers that if they would only get a little experience as scenic artists and find out the difficulties against which the artist has to contend it would save them a lot of trouble. We get young, enthusiastic, would-be designers bringing us things that they no doubt think are beautiful—they may be, but they are also quite impractical. They will not take the trouble to find out what can be done and what cannot be done.

THE LECTURER: Of course, you are quite right. These things depend on the perfection with which they are carried out. All I meant was that often the hard way and the disillusioning way is sought when another way could be found. Mr. Clements will bear me out. Not long ago I was engaged to do a production of *The Wild Duck*, and at our first discussion the producer said that he wanted to run the first and second acts into one; that meant that there must be not more than a minute to change. Normally this heavy change was a fifteen-minute job, but we went for it and we did it in under a minute. I do not suppose it would have taken much longer if you had kept the curtain up and trundled the things round back to front. But when the curtain went up on the garret again the audience reacted in a way which I cannot describe—which the other method would have spoilt.

I agree with you that all young students could benefit enormously from a spell in the painting rooms, even carrying buckets about and mixing up size. I was very fortunate in my middle years in having two splendid assistants. One came from a scenic studio and I think now is the most distinguished designer in English films, John Bryan. We worked together for several years and it was a great experience for us both. Another, Edmund Hogan, came to me from the Royal College of Art. Alas, he was killed in the war, but he was just as talented.

THE CHAIRMAN: One of the questioners asked what is to happen to the dramatist who proposes great apparent difficulties of setting to a management or a producer. Well, a few years ago I received the manuscript of a play: the first act was divided into four scenes, the second three, and the last five. The stage direction for the third scene of the first act was 'outside the London Pavilion at night, buses and taxis pass at regular intervals'. Now does that put me off the play? No—in that case the play put me off the play. Had it been a work of genius, somehow those buses and taxis would have passed at regular intervals.

I now propose a heartfelt vote of thanks to Mr. Irving for a fascinating and stimulating lecture; and I would add to it a personal note of gratitude for all Mr.

Irving has contributed to my productions and for all that I have in the process learnt from him.

The vote of thanks to the Lecturer was carried with acclamation.

SIR STEPHEN TALLENTS (A Member of Council of the Society): Mr. Clements spoke of the special pleasure which it had given him to come and take the Chair for Mr. Irving. I am sure that I can speak on behalf of all this audience in marking the special pleasure which he himself has given us and the dignity which his coming has added to our proceedings. Moving on behalf of the Council of the Society a hearty vote of thanks to him, I venture to record one feature of this meeting. We do not too often enjoy in this theatre a luxury with which Chairman and Speaker have joined in delighting us this afternoon—the luxury of hearing good English not only clearly but also beautifully spoken.

The vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.

THE INHABITANTS OF SWITZERLAND

A paper by

SIR GAVIN DE BEER, F.R.S., F.S.A.,

Director, The British Museum (Natural History),

read to the Society on Wednesday, 12th February, 1958, with His Excellency Mons. Armin Daeniker, Swiss Ambassador, in the Chair

THE CHAIRMAN: Sir Gavin de Beer is known to most of you as a scientist and scholar, and as Director of the Natural History Museum, and it would be futile and even presumptuous for me to elaborate on his very outstanding scientific achievements. But there is another side to him, not so well known to you but one of which we Swiss are always mindful. To us, Sir Gavin is a formidable, if not a dangerous, man, for he knows much more about Switzerland than we do! Of course, I look at my country with the eyes of a native; but he looks at my country with the eyes of an historian and scientist, and sometimes through rosy spectacles of love. Just as a spare time amusement he writes books about Switzerland; many of us will know his *Escape to Switzerland*, *Speaking about Switzerland*, and that famous essay *Alps and Elephants*. But by no means is that the end of his knowledge of Switzerland. This afternoon we are here to enjoy another side of his spare-time research work, and I for one am quite prepared to learn much more about my country than I already know.

The following paper, which was illustrated with lantern slides, was then read:

THE PAPER

CAVE DWELLERS

It will come as no surprise that the earliest human inhabitants of Switzerland held the European altitude record of 8,000 feet above sea-level which they kept for 100,000 years. They are known from the deposits in caves such as those of Wildkirchli, Wildenmannlisloch and Drachenloch in eastern Switzerland, and others on the Rigi and in the Simmental, containing Palæolithic flint implements, traces of fire, and the bones of the animals which they hunted, including the cave-bear. Skeletons of the men themselves have not been found, but they probably belonged to the Neanderthal race.

The location of these caves, as well as their contents, shows that the Old Stone Age men frequented them before the last great Ice Age, because they were all covered or surrounded by ice during the Würm glaciation. At the greatest extension of this Ice Age, about 50,000 years ago, as revealed by the moraines which the glaciers built up, almost the whole of Switzerland was covered with ice, as far as the Jura mountains and the Rhine.

Just outside the rim of the glaciers, other caves have been found near Schaffhausen and Basle, in the Jura near Neuchâtel, and on the Salève near

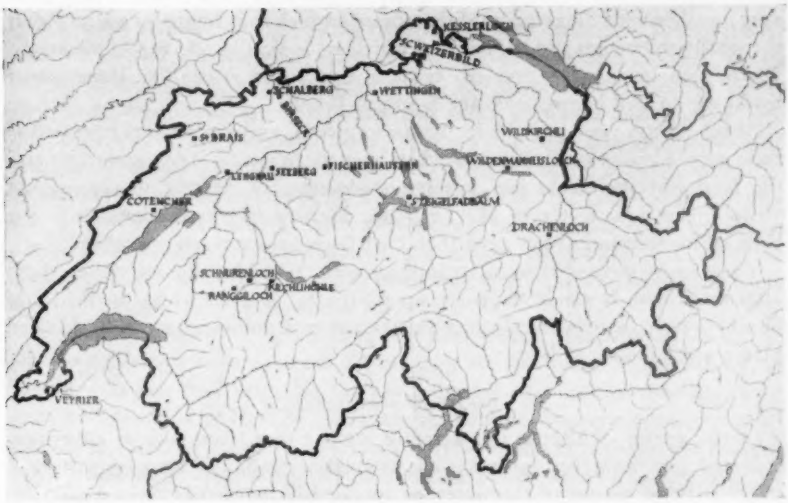

FIGURE 1. *Palæolithic stations of the Last Interglacial period (Ranggiloch —Wildkirchli), and of the Last Glaciation (Veyrier—Kesslerloch); Mesolithic stations of the Postglacial period (Lengnau—Fischerhausern)*

FIGURE 2. *The extension of the glaciers in the Last Glaciation*

Geneva, containing traces of later types of men who lived about 20,000 years ago, together with the remains of the animals which they hunted, now including the woolly rhinoceros and the reindeer which are indicative of a very cold climate. These men belonged to modern types and included artists like those whose works are so well known from the South of France.

About 15,000 years ago the ice began to recede, and the glaciers retreated to their alpine valleys. Almost immediately men followed them and colonized the land liberated from ice, forming settlements of Mesolithic type, about 10,000 years ago, at places like Lengnau, Seeberg and Fischerhausern in the plain of Switzerland which must then have been only recently uncovered.

These men were still hunters and, as such, nomads who wandered about after their prey. It was in the succeeding Neolithic period that Switzerland may be said to have received her first real inhabitants with domestic animals, cultivated plants and permanent homes.

LAKE-SIDE DWELLINGS

In the winter of 1853–4 the water in many Swiss lakes sank to an unprecedented low level and people were astonished to find a mass of posts and stakes sticking up out of the water, surrounded by potsherds, animal remains, and flint implements. Closer examination showed what appeared to be the remains of piles on which had formerly stood platforms bearing houses and sheds of groups of dwellings of the Later Stone Age, some 5,000 years old. As they seemed to have been built over the water, Ferdinand Keller gave to them the name of 'lake-dwellings'.

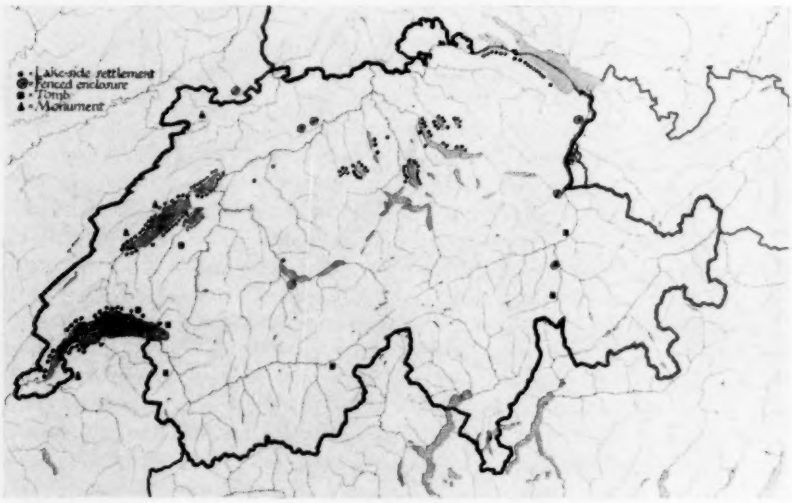

FIGURE 3. *Neolithic settlements*

There have been many attempts to explain why these prehistoric people should have gone to the trouble of building their homes over the water. It would have involved considerable technical skill, expenditure of time, and industry, to cut and shape and drive the piles under water, and prepare the platforms before they could start building their houses and sheds of wattle and daub, roofed with thatch and shingles. Some have supposed that the 'lake-dwellings' were designed for protection from wild beasts and men; but as the country away from the lakes was impassable, it was thought probable that the selection of the sites was due to their accessibility and convenience for communication by water. Furthermore, there would have been no protection from man or beast when the water was frozen hard, which it must often have been, nor for those settlements that were undoubtedly built on dry land.

It seems that much of this puzzling was unnecessary. The idea of prehistoric lake-dwellings has been accepted for so long that it comes as a shock to be reminded by Dr. Emil Vogt that there is no sound evidence that they were ever built over water. The level of the water in the lakes was not what it is now, and various indications such as traces of land-vegetation beneath the horizon of the dwellings point to the probability that they were erected on dry land, by the side of the lakes. What had previously been taken for piles and platforms were more probably posts and floors. Instead of 'lake-dwellings', it is clear that we should speak of lake-side dwellings. They are none the less interesting for that, and the arguments in favour of convenience of communication by water and of fish for food apply equally well.

THE FIRST HISTORICAL INHABITANTS OF SWITZERLAND

The earliest European peoples of whom history speaks were the Ligurians, who have given their name to a strip of coastline near Genoa. This was the last territory to which they were reduced and where they were finally subdued by the Romans in 181 B.C., but previously they had occupied large parts of Southern Europe including the North of Italy, the South of France, Corsica and Spain. Very little is known of the pre-Indo-European Ligurian language, but there are, however, certain place-names that are Ligurian, and to prove this, Corsica is extremely useful. The Celts never reached Corsica, and therefore any place-names found there that are pre-Roman are probably Ligurian. Among these are names ending in *-inco* and in *-asca*, which seem to be Ligurian place-name fossils.

From Pliny it is known that the Ligurian name of the river Po was *Bodincos*, and the ending *-inco* or *-anca* is found in Southern Switzerland, as at Altanca, Noranco, Lurenco, and Val Calanca.

The *-asca* ending is known to be Ligurian because of the inscription found near Genoa, which traced boundaries and gives the names of four rivers: *Tulelasca*, *Veraglasca*, *Neviasca*, and *Vinelasca*. D'Arbois de Jubainville pointed out that the former extent of Ligurian territory could be traced by looking for *-asca* place-names, and he indicated hundreds of them in Piedmont and Canton Ticino. Among the latter may be mentioned such well-known places as Biasca,

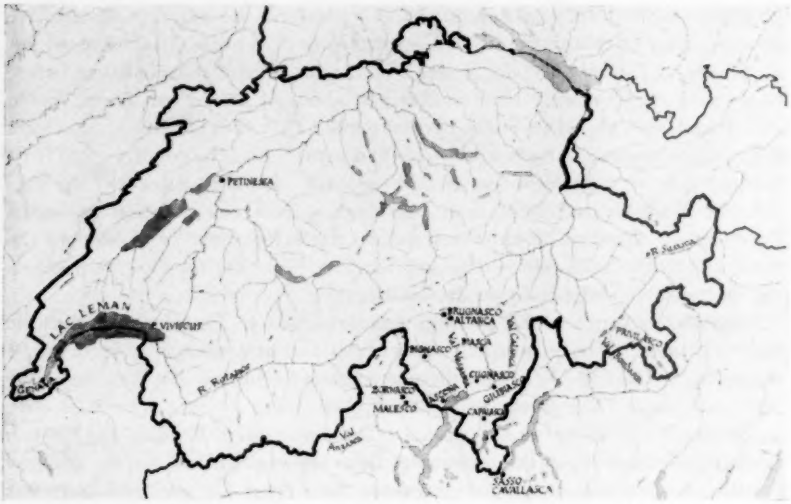

FIGURE 4. *Ligurian place-names*

Giubiasco, Cugnasco, Brugnasco, Ascona and the Valle Verzasca. Below Monte Rosa is the Val Anzasca, and near the Engadine is the Val Bondasca which must have been almost the eastern limit of the Ligurians, for no *-asca* names are found beyond the line of the Adige.

These names are also found in South-Western Switzerland, as in the Roman station of Petinesca near Berne and the Roman name of Vevey which was *Viviscus*. Indeed, there can be no doubt that the Ligurians lived on the shores of the Lake of Geneva, because the very name of Geneva, *Genava*, is the same as that of Genoa, *Genova*, and must have been given by the same people. The name of the Rhône, *Rotanos*, is Ligurian, and so is that of Lake Leman. Even the word alp, *alba*, for high pastures, is derived from the Ligurians.

Outside Liguria, the Ligurian people have either been submerged in the Celtic and Roman populations, or exterminated. There is, however, a possibility that a pure remnant of these earliest historical Europeans may survive in the Basques, as was suggested by Elisée Reclus. Their country, which itself is called Biscaja, contains *-asca* place-names such as Villamerisca, Velasco; their language is called Euskara, and their own name Basque or Vascuence, and that of Gascony, derived from the tribe of the Vascones whom Pompey subdued, contain the Ligurian suffix. Liguria and the Basque country are connected by the South of France, where *-asca* names are also found, as in Manosque, Venasque, Lambesc, Artignosc, Flayosc, Gréasque, Vilhosc, Albiosc, and two Tarascons, and by the North of Spain, where Venasca and Huesca are other examples.

Evidence from physical anthropology to connect the Basques with the Ligurians is hard to find, owing to the difficulty of identifying ancient Ligurian skeletons. From blood-groups, however, an indication of affinity can be obtained. The Basques are the people with the highest-known percentage of rhesus-negative subjects in the population. It is therefore striking to find, as Dr. A. E. Mourant's maps show, that the region of Italy where the percentage of rhesus-negative subjects is highest is precisely Liguria.

With the exception of Southern Greece and the Toe of Italy, there are only two places on the continent of Europe where the gene responsible for blood-group A is present in frequencies below 25 per cent of the population: the Basque country and Liguria. It also falls below 25 per cent in Corsica, Sardinia and Sicily. If the Basques and the Ligurians were members of a pre-Indo-European Mediterranean race, the presence of low frequencies of the gene in Southern Greece and Southern Italy is in accordance with these conclusions.

Furthermore, there is a small area in Liguria near Genoa where the frequency of the gene responsible for blood-group O exceeds 70 per cent of the population. Elsewhere in Southern Europe this is only the case in the Basque country, in a small area in the Heel of Italy, in Corsica, and in Sardinia.

Swiss prehistorians believe that there were no invasions or migrations of peoples through what is now Swiss territory during the Bronze Age, although there may have been local wanderings. If this view is correct, it means that there must have been a continuity from the latest invaders of the Neolithic period through the Bronze Age to the beginning of the Iron Age.

During all this time, there seem to have been two different types of people in the country. In the central and northern regions there were those who practised the Corded-Ware Culture, of Eastern origin, and their Bronze Age heirs who buried their dead under tumuli. From the south-west and Mediterranean regions there came the Bell-Beaker people, and their Bronze Age heirs who buried their dead in flat graves, with hammered sheet bronze ornaments, particularly in the alpine zone.

From the researches of Hrozny and of Ventris and Chadwick and others, it is clear that of the Indo-European languages, Hittite and Greek were already fully formed in the middle of the second millenium B.C.; and as there is no reason to suppose that the Celtic, Italic or Germanic branches of language were subsequent in date, it follows that Celtic must also have been established and current in the second millenium B.C. But if there were no invasions of Switzerland during the Bronze Age and there was continuity of culture into the Iron Age, and as the Iron Age people of Northern and Central Switzerland spoke Celtic to Julius Caesar, it follows that Celtic must have been the language of the people in those regions throughout the Bronze Age. It is tempting to suppose that the language spoken in the alpine zone was Ligurian.

LA TÈNE

At the eastern end of the Lake of Neuchâtel, where the river Thièle flows out of it, is a place called La Tène, which has given its name to archæological finds

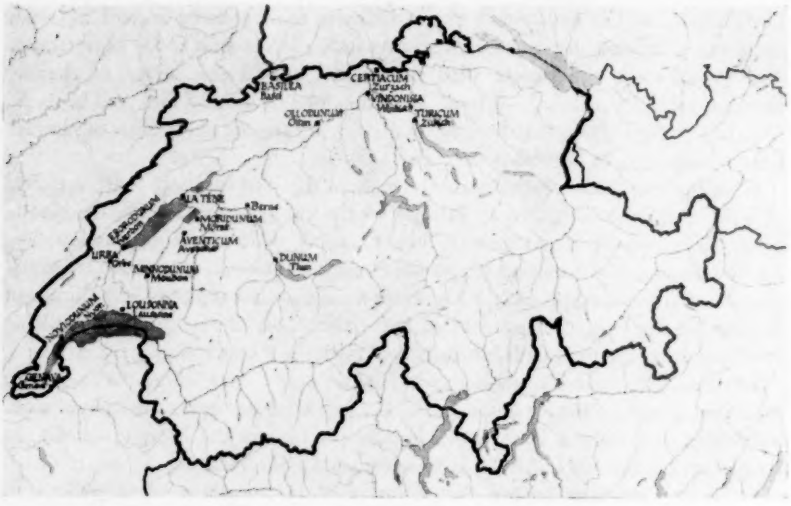

FIGURE 5. *Celtic settlements with their Latin names (where known) and modern equivalents. (Certiacum should read ? Tortiacus)*

of the Later Iron Age, all over Europe. The station of La Tène was inhabited from about 400 B.C. until about 100 B.C. It was a settlement on the banks of the river, connected by two bridges on piles. Traces of six houses were found, and the remarkable thing about their contents was the large number of similar objects that they comprised. These included 166 swords, 37 scabbards, 57 sword-slings, 180 buckles, 164 lance-heads, 27 shields, many horses' bits, wheels, parts of wagons, a saddler's outfit of 19 tools, many cauldrons, spears, knife-blades, and 29 two-handed scythes.

There can be no doubt that La Tène was a military outpost and arsenal, for a company guarding the crossing point at the end of the lake, together with transport and foraging equipment.

It is possible that the inhabitants of La Tène can be identified. The south-western part of Switzerland was occupied by the Celtic tribe of the *Sequani*, whose capital was Besançon, and in whose territory Ptolemy described the towns of Avenches and Nyon.

Separated from the *Sequani* by a frontier probably passing through La Tène were the *Helvetii*, who occupied the remainder of the Lowlands of Switzerland. One of their tribes, the *Tigurini*, took part in the ill-fated attempt of the Cimbrians to invade Italy over the Brenner Pass in 101 B.C., when the latter were annihilated by Marius at Vercelli. The *Tigurini* went home again, and it must have been then that they pressed the *Sequani* back over the Jura and made Avenches their capital, as Tacitus relates. Perhaps the abolition of the old frontier between the *Tigurini* and the *Sequani* was the reason why La Tène was abandoned.

The first traveller through Switzerland about whom anything definite is known, was the Greek Posidonius of Apamea, a friend of Marius, Cicero and Pompey, who travelled through the Celtic lands in about 80 B.C. 'Posidonius informs us', wrote Athenaeus, 'that among the Helvetii and some other Celts, women and invalid men rub down the sand carried by the rivers, extract the gold dust and wash it clean, and carry it to the melting pits.' It is quite clear that this refers to the Emmental between Berne and Lucerne where a stream, still called the Goldbach, flows into the Emme and so into the Aare and the Rhine. There is another reason why this river gold is of interest, for there are no gold-bearing streams in the Black Forest, and the Rhinegold of the Niebelungen Legend was this Swiss gold of which Posidonius spoke.

In Caesar's description of the *Helvetii*, he specified that they had twelve defended towns or *oppida*, four hundred villages and many single homesteads. It is an exercise of considerable pleasure to try to identify the twelve towns. There are two methods of doing so. One is by looking for fortified places of the type which Celts liked, usually on a mound or bluff surrounded by arms of rivers, and where archæological finds of La Tène culture have actually been made. The other method makes use of the fact that the Celtic word for fortified town was *dunum*, as in *Camelodunum*, Colchester, and involves looking for place-names with this ending.

By the former of these methods the following are identified: Lausanne, where the *oppidum* was the site of the Château between the Louve and the Flon; Berne in the loop of the Aare; Windisch, the old *Vindonissa*, between the Aare and the Reuss. By the latter method, *Noviodunum* or Nyon, *Minnodunum* or Moudon, *Eborodunum* or Yverdun, *Ollodunum* or Olten, *Dunum* or Thun, can be recognized. To these may probably be added Zurzach (? *Tortiacus*), *Turicum* or Zürich, and perhaps *Moridunum* or Morat. Basle on the hill where the minster stands between the Rhine and the Birsig was an *oppidum* of the *Rauraci*; *Genava* between the Rhône and the Arve was an *oppidum* of the *Allobriges*.

La Tène is certainly one of the most important archæological stations to have been discovered, with its direct bearing on historical texts. But there is an additional reason why it is of interest. When Jason in the Argo left the Black Sea with the Golden Fleece, he sailed up the Danube. Apollonius's geography was very confused, but there can be little doubt that after a lot of wandering and portage, the Argonauts found themselves about to sail down the Rhine. But the goddess Hera was terrified lest they should follow it to its mouth into the North Sea, where they would have been lost to humanity. She therefore stood on the summit of the Black Forest and gave a great shout which Jason fortunately heard and understood, so he turned up the Aare and passed through the so-called Celtic Lakes. But these are known to be the lakes of Bienne, Neuchâtel and Geneva; so the Argonauts must have left the Aare and sailed up the Thièle through the first two lakes, and then made a short portage to the Lake of Geneva where they were on the Rhône, down which they returned to the Mediterranean and civilization.

This means that the Argonauts sailed past La Tène.

THE RAETIANS

While most of Switzerland came to be occupied by Celtic tribes, the valleys of the Grisons and Tyrol had a different fate. In the Late Bronze Age, from about 1000 B.C., these valleys were occupied by tribes who practised what is known as the Melaun culture, in places succeeded by Hallstadt culture. These people who came from the East appear to have been Indo-European and related to the Illyrian stock, and to have become the *Raeti*, whose name persists in that of the Roman province of Raetia. The suffix *-st*, seen in Triest, is found in places like Peist and Andeest in the Grisons.

Up to the fourth century B.C. the valley of the Po was inhabited by Etruscans, but when these fertile lands were invaded by the Gauls who founded *Mediolanum* or Milan, the Etruscans were driven out and according to Livy and Pliny took refuge in the mountains of Raetia, where they must have intermingled with the *Raeti*. This is borne out by place-names and by objects and inscriptions found in those valleys.

The suffix *-enna* is Etruscan as in Ravenna, and it occurs in Varenna, Chiavenna, and Tenna in the Grisons. Bronze helmets have been found at Obersaxen in the Upper Rhine Valley, at Igis near Coire, and at Giubiasco near Locarno, of undoubted Etruscan type. The inscriptions found near the Brenner Pass, Bolzano, Innsbruck, Sondrio and the Lake of Garda are written in alphabets with Etruscan characters and some Etruscan words.

In both Raetic and Venetic inscriptions, a word which occurs frequently is *reitia* and seems to denote the name of a goddess of healing to whom dedicatory objects were offered. It is tempting to think that her name is the basis of Raetia,

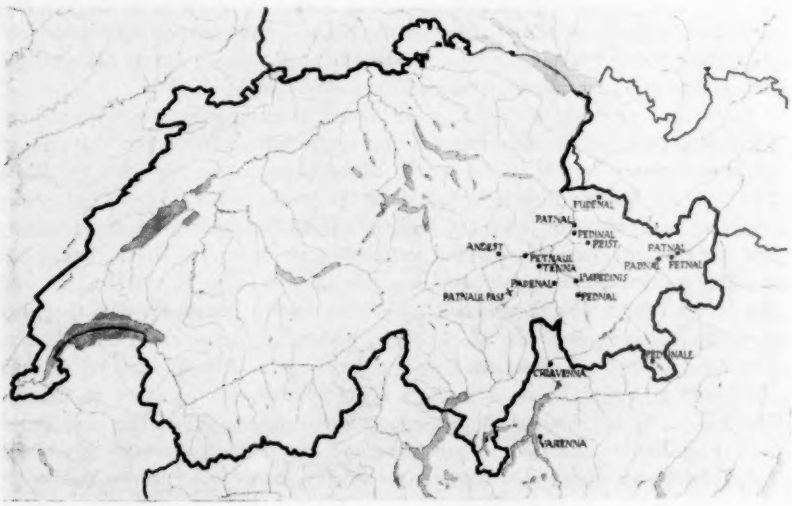

FIGURE 6. *Raetic place-names*

for the legend advanced by Roman authors that *Raetus* was an Etruscan chief who led his people into the mountains called after him, was clearly an invention.

It so happens that in the heart of the Grisons there is evidence of religious dedications to a healing Deity. At St. Moritz in the Engadine, the famous hot springs were in use in the Late Bronze Age, for the water was led in wooden conduits into wooden tubs, and beneath them were found three bronze swords and a dagger, two of them lying horizontally and two placed perfectly upright, obviously intended as votive offerings.

The Raetic people were tough and rough. Indeed, they were so savage and bloodthirsty in their raids that in 15 B.C. Augustus was obliged to crush them in a remarkable campaign. Drusus with one army drove up the valley of the Adige from the south, while Tiberius, the future Emperor, swept across Switzerland from the west to the Lake of Constance. Eventually the Roman power was established at *Curia Raetorum*, now Chur.

This war was sung by the poet Horace, who referred specially to the strongholds of the *Raeti* set on alpine fastnesses. Several such strongholds have been discovered, and a surprising number of them bear the name Padnal, Petnaul, Pedenol, or some similar variant. Examples are to be found at Untervaz, and Trimmis in the Rhine valley near Chur, and at Kästris near Ilanz; Clugin near Andeer in the Schamsertal; Tiefenkastel and Savognin in the Oberhalbstein on the way to the Julier Pass; the Patnaul Pass between Vals and Vrin; Süs, Fetan, Giarsun, and Remüs in the Lower Engadine; San Antonio near Poschiavo; and at the foot of the Scesaplana in the Prätigau.

The name Patnal appears to be the Raetic equivalent of the Celtic *dunum*, as Robert von Planta has proposed.

Under the Romans the inhabitants of Raetia adopted the Latin language which they transformed into Romansch, of which one dialect is called ladin. Not only is it very primitive in preserving such words as *il cudesch*, the book, Latin *codex*, and *la maisa*, the table, Latin *mensa*, forms which have been lost in other languages derived from Latin, but it has remained almost unchanged from the earliest manuscripts until the present day. In A.D. 842 Charlemagne's grandsons swore on Oath at Strasbourg, and Lewis the Germanic swore it in Romance so that the subjects of Charles the Bald, King of France, might understand. The words of this Oath in Romance of the ninth century are practically identical with what they would be in Romansch of the Grisons to-day.

HOARDS AND HORDES

It has long been a puzzle why the Romans, who were so methodical and thrifty, should have been so careless as to throw their money about, not only in single pieces, but in bucket-fulls, since so many finds of hoards are dug up, all over the former Roman Empire. The solution of this puzzle was found by M. Adrien Blanchet, who pointed out that the hoards of coins must often have been deliberately buried to hide them from the barbarians when they raided or threatened to raid the places where the wretched people lived. Furthermore, an indication of the date of the burial is given by the date of the latest coin in the

hoard. There is here, therefore, a method of tracing the date and places of barbarian raids, and of studying the pattern of their operations.

Nowhere can this method be applied to greater advantage than in Switzerland where, during the Roman period, a rich population was exposed to the danger of raids by the German tribes from across the Rhine. During the first and second centuries A.D., when the Roman Empire was being extended and its frontiers carried to the Main and the Danube, there was no such danger in Switzerland. But in the third century the frontier was withdrawn to the line of the Rhine from Basle to the Lake of Constance, and the danger became acute.

By plotting on the map the places where hoards of coins have been found in Switzerland, with the date of the latest coin in each hoard, the pattern of the raids emerges.

GRIMM'S LAW AND THE GERMAN INVASION

The language frontier that separates the German-speaking from the French-speaking inhabitants of Switzerland runs right across the country from a little west of Basle in the north to the ridge of the Weisshorn that separates Zermatt from Zinal in the south.

In A.D. 436, Aetius, the Roman Governor of Gaul, smashed the Burgundians who had established themselves on the Rhine near Mainz, and whose downfall was the basis of the legend of the Niebelungs. Aetius then settled the remnants of the Burgundians on the southern shores of the Lake of Geneva near Evian.

During all this time the inhabitants of Switzerland were romanized *Helvetii*, Celts and Gauls, who spoke Celtic with a veneer of Latin. Presently the Roman Empire in the West collapsed under the attacks of the Goths, and Switzerland became a power-vacuum which was filled in the following way: From the south, the Burgundians left their settlements, crossed the Lake of Geneva and expanded into Western Switzerland. At the same time, the *Alemanni*, tribes of Germans, crossed the Rhine from the north and streamed down into Central and Eastern Switzerland. Where the Germans came, the Celtic language of the Gallo-Roman inhabitants was suppressed and the German language established. On the other hand, in the region overrun by the Burgundians, who themselves had already become considerably romanized, the language of the Gallo-Roman inhabitants continued to undergo its normal evolution into a type of Frankish-Provençal, as also spoken in Franche-Comté and Savoy. This language was characterized by names ending in *–a*, which explains the names of places like Evolena, Rivaz, La Sarraz, Evionnaz, Anzeindaz, La Comballaz, which are so numerous in those regions. This *–a* is not pronounced to-day, because the French phonetic system allows only a mute *–e* to follow the syllable on which the accent falls.

It was only in the last few centuries that French of Paris was substituted for the local dialects, largely as a result of the pastors spreading Calvinism, of the lawyers who drafted their deeds in French instead of in Latin, and of the universities and schools.

In the French-speaking region, traces of the Burgundians are common in

FIGURE 7. *Occupation by Burgundians and Germans. Burgundian and Frankish place-names in italic capitals; Latin names in roman capitals; German names which have undergone shift in roman lower case; German names which have not undergone shift in italic lower case.* (*Certiacum should read ? Tortiacus*)

names of place-endings in *–ens*, like Renens, Thierrens, or Vufflens, which represent the old Burgundian suffix *–ingen*.

In the German-speaking region, a curious accident of philology has made it possible to trace the history, the directions, and the timing of the German infiltration. During a period of time approximately covering the sixth century, the Southern Germans changed their pronunciation in accordance with principles usually referred to as Grimm's Law. The Old High German Consonantal shift resulted in changing *d* into *t* or *th*, initial *t* into *ts*, which is the German *z*, initial *p* into *pf*, and in changing *c* usually into *ch*. These changes make it possible to determine roughly when a particular place was occupied by the Germans, because when the Latin name of a place is represented to-day by a German name which has undergone the consonantal shift, it means that the Germans were already there in the sixth century, and the name of the place underwent the same changes as Old High German. On the other hand, when the Latin name of a place has passed into German without undergoing the consonantal shift, it means that the Germans did not reach it until later, perhaps in the seventh century, after the period of the consonantal shift had finished.

One of the chief crossing places over the Rhine, where the Germans must have crossed, is Zurzach, which shows the shift in both *z*'s and the *ch* from a possible *Tortiacus*, though the Latin name is uncertain.

From there it can be seen how the Germans fanned out to the south-west, south, and south-east, and went up the river valleys. Up the Aare, to the south-west, they came to *Salodurum*, and its name changed into Solothurn. A little further on, they came to the river *Tela*, which became the Zihl. Finally, they came to *Dunum* at the head of its lake, which was changed into Thun. To the south up the valley of the Reuss they came to the Lake of Lucerne, on the shore of which *Alpiniacum* became Alpnach. On the nearby Lake of Zug, *Cama* became Cam, and *Tugium*, Zug.

To the south-east, up the valley of the Limmat, they came to *Turicum*, the name of which became Zürich. Proceeding further up the Lake, they reached *Ad Lacum*, which name was changed to Lachen.

To the east they came to *Ad Fines*, the Roman frontier station, which is now Pfyn, and the river *Dura*, which became the Thur. In this region, *Vitudurum* became Winterthur, and the fact that the first *t* was not changed into *z* shows that the Germans did not reach it until late, when the period of the consonantal shift was nearly finished.

All the places so far mentioned are easily accessible from the north by the river valleys, and are low-lying, either on the rivers themselves or on lakes. Away from the valleys the country must have been of difficult access, not only because of the mountains but also of the forests which covered much of the land. In such areas, Latin names of the places are found not to have undergone the consonantal shift. Examples in the valley of the Aare are *Corniculum*, to-day Gurnigel; *Saxetum*, to-day Saxeten near Interlaken; and *Alpicula*, to-day Alpiglen found in many alpine valleys. Above the Lake of Zürich, *Castra* is Gaster. Near Lucerne, *Culmen* has become Gulm. *Cortinella* is Gurtnellen. *C* has become *g*, but not *ch*.

The hilly region of the Jura is particularly interesting for tracing the infiltration of the Germans, who must have found it a serious obstacle. They overran it first from the east, as is shown from the fact that *Vocetus Mons* became the Bözberg. But the important pass over the Hauenstein must have been in the hands of Frankish-speaking inhabitants for a long time, because the names of places on its route did not undergo the consonantal shift when converted into German: *Pratellum* (little meadow), to-day Pratteln; *Campus* (open field), to-day Gempen; *Nuvariolum* (nut grove), to-day Nuglar; *Buxetum* (box trees), to-day Buchsiten.

There is another philological principle which helps to understand the distribution of German and French-speaking inhabitants, especially in the Jura. In German compound words involving a proper name, the proper name comes first, as in Bismarkstrasse or Ingolstadt. In French compound words and expressions the proper name comes last, as in Rue Victor Hugo, or Bourg St. Pierre. A common form in Jura villages is to find the word court, Latin *curtis*, a homestead, combined with the name of the owner. Courtelary, 'Alaric's house', has his name last and shows that it was long occupied by Frankish-speakers. Vendelincourt, 'Wenceslas's house', has his name first and shows that

FIGURE 8. *Ancient tribal frontiers and old diocesan boundaries*

this village was occupied early by the Germans. By this means the temporary language frontier can also be traced.

ANCIENT TRIBAL FRONTIERS AND DIOCESAN BOUNDARIES

In addition to the evidence provided by epigraphic inscriptions, historical texts and numismatics, there is another method by which ancient frontiers between tribes can be traced. Auguste Lognon drew attention to the fact that when the Romans made a conquest, they used the original tribal organization of the conquered peoples as a basis for the Roman *civitas* which they established in the newly acquired territory, which became a unit of administration. This is how it came about that the boundaries of the *civitates* frequently followed those of the original Celtic, Raetic or Germanic tribes. But when Christianity spread through the Roman Empire, the ecclesiastical organization of the dioceses was based on that of the *civitates*, the capitals of which became the sees of bishoprics.

In the course of nearly two thousand years, dioceses have been merged, annexed or abolished; but the situation of their boundaries remains known, and in many cases these boundaries persist and reflect the original frontiers between the tribes before the Roman conquest.

THE WALSER COLONIES

The German-speaking inhabitants of the Grisons did not reach their present abodes direct from the plains of Switzerland when it was overrun by the *Alemanni*, but by the most circuitous route.

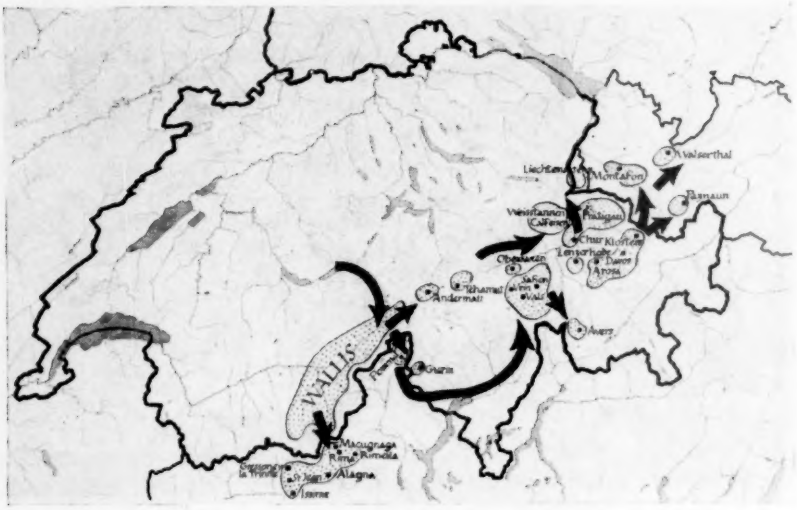

FIGURE 9. *The Walser emigrations*

In the ninth and tenth centuries, some of the tribes in Central Switzerland pushed up the valley of the Aare beyond the Lakes of Thun and Brienz, and crossed the Grimsel Pass into the Upper Valais, which they occupied as far as Brig. Practically all the names of the alps and mountains there are German, which shows that the region must have been almost uninhabited when the *Alemanni* arrived, as Romance names would otherwise have persisted.

After some three hundred years of existence in the Upper Valais, these Walsers, as they may be called, undertook some extremely remarkable emigrations. In the thirteenth century some of them crossed the Furka Pass and settled in the Urserental and Andermatt. Others crossed the Monte Moro Pass from the Valley of Saas to Piedmont on the southern side of Monte Rosa and established half a dozen villages: Macugnaga, Rimella, Alagna, Rima, Gressoney and Issime, where a primitive German is still spoken.

Over the Gries Pass the Walsers overflowed into the upper region of the Val Formazza, where they still speak German. From there one colony crossed the Furka del Bosco and established the village of Gurin, which has the distinction of being the only German-speaking community in the whole of Canton Ticino.

Other groups of Walsers travelled further. From the neighbourhood of Locarno which they reached through the Val Formazza, they moved north east and, over the San Bernardino Pass, entered the present territory of the Grisons. There they fanned out and gave rise to a dozen separate and isolated colonies in as many valleys, where German is spoken to-day, as in the valleys of Splugen,

Vrin, Vals, Safien, Avers, the Upper Rhine and Lukmanier, Obersaxen, Davos, Klosters, and Arosa, St. Anthönien, Chur and Lenzerheide.

Some groups of the Walsers moved on further out of the territory of the Grisons and became established in the Calfeisen and Weisstannen valleys of Canton St. Gall, in the Principality of Liechtenstein, in the Montafon valley of Vorarlberg, at the heads of the valleys of Lech and of the Walserthal, the name of which speaks for itself, and of Paznaun in Tyrol.

In all these places the Walsers cleared what had been sparsely inhabited areas of forest at the heads of the valleys, leaving the remainder of the ground in the Grisons to the Romansch-speaking inhabitants, and this is why in this Canton there are so many isolated German-speaking 'islands'. Traces of the former Romansch-speaking inhabitants are found in names of places such as Strela and Clavadel at Davos, Furna below Klosters, and Arosa.

With them the Walsers brought many customs and characters which enable them to be recognized and distinguished.

Some of the Walser colonies in Piedmont have preserved the gothic word *atto*, father; and at Davos *ätti* is still used with the same meaning.

The isolation in which some of the Walser colonies in the Grisons have lived for many centuries renders them particularly suitable for serological studies, and especially for the relative proportions in which the main blood-groups are found in their populations.

Taking first the ABO groups, it is found that in Switzerland as a whole their distribution in the population is 42 per cent O, 47 per cent A, 8 per cent B and 3 per cent AB. Several colonies of the Walsers have been investigated for their blood-group distributions by Schütz, Moor-Jankowski and others who showed that they not only resemble one another fairly closely, but also differ from the remainder of the population of Switzerland. Average values are 61 per cent O, 32 per cent A, 5 per cent B, and 2 per cent AB, which shows a remarkable predominance of group O and a lack of group B. Similar values were found in the Upper Valais.

Furthermore, when investigated for the Rhesus-factor, the Walser colonies so far studied show a significantly higher proportion of Rhesus-negative people (22 per cent) than the population of Switzerland as a whole (16 per cent).

CONCLUSION

The inhabitants of Switzerland have now been traced to their present haunts, thanks to a multiplicity of fields of research which have made it possible: glaciology has elucidated the conditions during the Ice Age, palæontology the animals associated with man in the Stone Age, archæology the life of the Bronze and Iron Ages, investigation of blood-groups the relationships of Ligurians and Walsers, place-name studies the location of Ligurians, Celts, and *Raeti*, Burgundians and *Alemanni*, numismatics the pattern of German raids, linguistics that of their infiltrations, and geography of diocesan boundaries the delimitation of Celtic, Raetic and Germanic tribes. All these branches of science

and scholarship have come to the aid of history or the study of ancient classical texts, and have supplemented and extended it. Switzerland is only a small country, but the interest which it raises by providing a theatre for the combined solution of such problems is unbounded.

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THE CHAIRMAN: I think my prophecy was correct. I have learned many new things, and those things of which I already knew a little I now see in a new light. Although the places of man's evolution go back to the Palæolithic period, the work on local sites started only about a hundred years ago, and as long as this knowledge was bricked into a watertight compartment and the help of other branches of science was not asked for, it was almost impossible to relate these discoveries one to another. Only since the advent of men like Sir Gavin de Beer, with minds enlarged through achievements in other spheres of knowledge, has it been possible to correlate the many thousand individual finds and reconstruct them in a picture of the life of our forefathers during the last fifteen or twenty thousand years. I am glad to say that my country has recognized the outstanding service of Sir Gavin by awarding him an honorary doctor's degree.

A vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman, the meeting then ended.

GIBBERELLIC ACID: A NEW PLANT HORMONE CONTROLLING GROWTH AND FLOWERING

The Fernhurst Lecture by

P. W. BRIAN, Sc.D., Ph.D.,

Head of the Department of Microbiology, Akers Research Laboratories, Imperial Chemical Industries Ltd., delivered to the Society on Wednesday, 26th February, 1958, with T. A. Bennet-Clark, M.A., Ph.D., F.R.S., Professor of Botany, University of London King's College, in the Chair

THE CHAIRMAN: We are privileged to have Dr. Brian here this afternoon to give us an account of what is, I suppose, one of the most exciting developments in botany in the last two or three decades. It began by work in Japan on a disease known as *bakanae*, which means, I believe 'foolish seedling' in Japanese; and that work, so to speak, opened up a furrow in which the most striking edifice has been built. I think much of the foundation work and the building of the edifice has been done in the Akers Laboratories, of whose Microbiological Department Dr. Brian is Head. So we are to hear about this development from the very place where the greater part of this building of new knowledge has been erected.

The following lecture, which was illustrated with lantern slides, was then delivered:

THE LECTURE

INTRODUCTION

The subject of my lecture is in many ways different from those chosen by previous Fernhurst Lecturers. Earlier lectures have all been concerned with some general aspect of the application of science to agriculture and have been based on developments covering many years. I, on the contrary, shall be taking the course of describing the effects of a small group of closely related substances, of which gibberellic acid is the best known, on plant growth and development. Most of the work I shall discuss has been done in the last four years and its practical implications are, as you will see, still rather uncertain. But though gibberellic acid had not been heard of four years ago, it is to-day engaging the attention of hundreds of plant physiologists and agronomists in most countries of the world. I am emboldened to break with tradition in choosing so narrowly delimited a subject, because I think you will find the story behind this new development in many ways fascinating and illuminating; it illustrates remarkably

well how a simple observation may have completely unexpected repercussions in other branches of science.

DISCOVERY OF THE GIBBERELLINS

Though, as I have said, world-wide interest in gibberellic acid has only very recently developed, this work had its origin in some observations made more than thirty years ago. In 1926 a Japanese plant pathologist, Dr. E. Kurosawa, was investigating a disease of rice colloquially known in his country as the *bakanae* disease. This disease is caused by infection of the rice plants by a soil-borne fungus identified some years earlier as *Gibberella fujikuroi*. A noteworthy feature of this disease is that, when first infected, diseased plants grow taller than healthy ones; later they may become weak and eventually die. Kurosawa showed that if he grew the parasitic fungus *G. fujikuroi* on a nutrient medium for two or three weeks, then filtered the fungus off and treated healthy rice seedlings with the filtrate, such seedlings immediately grew more rapidly without any actual infection by the fungus. He concluded that some metabolic product of the fungus, which had accumulated in the culture fluid, must have plant growth-promoting properties. This observation attracted little attention outside Japan, but in that country work on isolation and purification of the growth-promoter was initiated. Progress was slow but eventually, in 1939, Professor

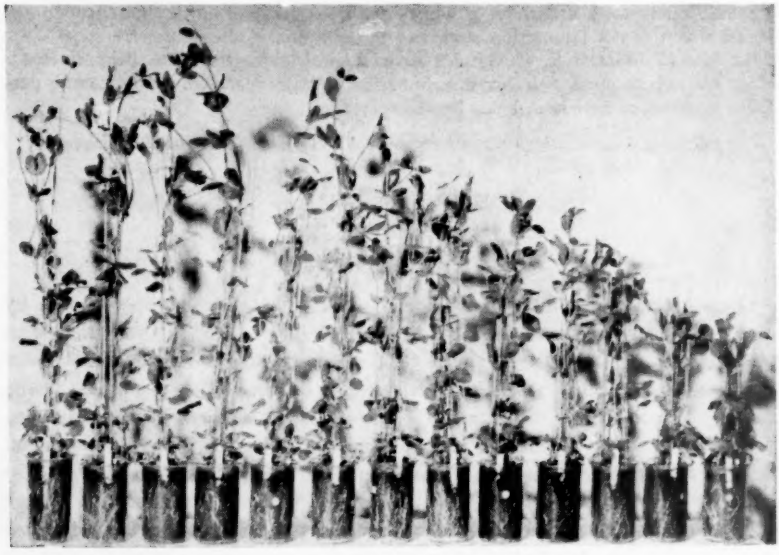


FIGURE 1. *'Meteor' pea seedlings 26 days after application of gibberellic acid.* Looking from right to left: *Nos. 1 and 2 were untreated; No. 3 received 0.01 microgram gibberellic acid; thereafter doses increased in twofold steps, No. 13* (on the extreme left) *receiving 10.24 micrograms*

Yabuta and Dr. Hayashi isolated a crystalline growth-promoting substance which they later called gibberellin A. It was found to promote growth of many species of plant. More recently, Japanese chemists have suggested that this substance, believed when first obtained to be pure, was in fact a mixture of several different growth promoters, conveniently known collectively as gibberellins.

The first pure gibberellin was obtained in England. Many years after the description of gibberellin A in Japan, an interest developed in other countries; I shall discuss later the reasons for this delayed reaction. In attempting to repeat the Japanese work, Mr. P. J. Curtis and Dr. B. E. Cross, colleagues of mine at the Akers Research Laboratories of I.C.I., isolated in 1954 a substance obviously chemically and physiologically similar to the Japanese gibberellin A, but nevertheless distinct; they called this substance gibberellic acid. Shortly afterwards, as a result of a completely independent approach in the United States, Dr. F. Stodola described a new gibberellin which he called gibberellin X; this was found to be identical with gibberellic acid. Several pure gibberellins are now known. They are probably fairly closely related chemically and all have similar effects on plant growth. In order to simplify the account of their biological effects which follows I shall not attempt to distinguish between them, but shall refer to any or all of them by the abbreviation GA. The pure substance which has received most attention is gibberellic acid, and this is also a major constituent of a gibberellin mixture which has been widely used in experimental work in the United States.

EFFECTS ON VEGETATIVE GROWTH OF PLANTS

As we have seen, a characteristic symptom of the *bakanae* disease is that infected seedlings are normally tall. A characteristic effect of GA on plants is to make them taller. This is shown particularly well with garden peas (Figure 1). The increase in height in this case is due to increased length of stem internodes; the number of internodes is not affected. Internodes of plants with GA reach maturity and cease extension at the same time as those of untreated plants, but while they are extending they do so much faster and hence reach a greater final length. Figure 1 also shows that within a certain range the increase in height following treatment with GA is proportional to the dose applied. Doses as small as 0.01 microgram per plant will produce an easily detectable increase in height. The increase in internode length is due to increased cell length; GA causes increased cell extension under such circumstances rather than increased cell division.

The effects of GA on plants which normally branch are even more striking (Figure 2). Thus, if it is applied to a dwarf French bean or a Cupid sweet pea plant, the plant does not grow in its usual bushy, branched form, but all of the growth is confined to a single axis which may contain many more internodes, each larger than normal, than that axis would normally contain. In such cases, where GA enhances apical dominance, in addition to promoting cell extension in the developing internodes, it must in some way encourage continued cell division at the apical bud, which would normally cease to function.

FIGURE 2. *French beans:* left, *untreated;* centre, *treated with 1 microgram gibberellic acid per plant;* right, *treated with 10 micrograms*

So far we have concerned ourselves with stem growth. When GA is applied to cereal plants, though stem growth is enhanced, the effect on leaf growth is even more striking. Rice or wheat (Figure 3) leaves may reach twice their normal length as a result of GA treatment. In dictyledonous plants effects on leaf growth are variable; the leaves of some plants, for example, the garden pea, increase in size only slightly if at all, whereas others, for example, French or runner beans, may show great increases in leaf size.

Root growth does not appear to be directly affected by GA. Usually the greatly increased shoot growth is not at first accompanied by any increase in root growth, so that the root:shoot ratio is decreased; it is possible that subsequently root growth is secondarily enhanced, but there are no critical experimental data bearing on this point.

Associated with the increased size of shoot induced by GA, there is sometimes an increased dry weight; in other words, carbon fixation from the carbon dioxide of the atmosphere is greater. It appears most likely that this is not due to any direct effect on the efficiency of photosynthesis but arises secondarily as a consequence of increased area of photosynthetic surface.

This brief account gives a general picture of the effects of GA on vegetative growth of plants. This picture needs to be qualified in one respect—different plant species, or varieties within a species, may differ in the magnitude of their response. Some plants are only slightly affected by GA, whereas others may be increased in height four- or five-fold. Many of these facts had been established at least qualitatively by Japanese workers before any interest in GA had spread to other countries, but the further effects I shall describe below were first

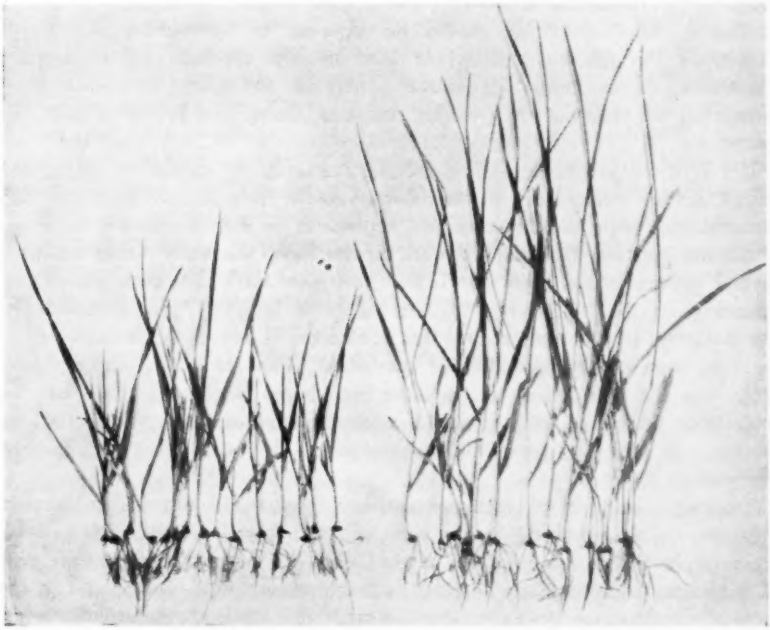


FIGURE 3. *Wheat seedlings grown in Pfeffer's culture solution* (left) *and* (right) *in a similar solution containing 2 micrograms gibberellic acid per ml. of culture solution*

described in the last three of four years by workers in other countries, notably in Great Britain and the United States.

EFFECTS ON FLOWERING

The most striking of these effects is on flowering; our knowledge of this is to a great extent due to the pioneer work of Dr. Anton Lang of the University of California. Many plants will flower in most normal environmental conditions; others only flower if exposed, at least for a time, to quite critical conditions of lighting or temperature.

The effect of light is concerned with the length of day and night. Some plants flower best if exposed to continuous light, and will fail to flower if the dark period (night) in any 24-hour cycle is too long—a critical length of the dark period may be determined for such plants. These are called *long-day plants*. Many familiar plants of our latitudes are of this kind, for example such annual plants as parsley, lettuce and spinach. Other plants, which we may call *short-day plants*, will not flower in continuous light and will only flower if the dark period is longer than a certain critical length, varying from species to species. Many tropical species belong to this category, but they are not exclusively plants of low latitudes: examples are some varieties of soybean and tobacco, and the greenhouse ornamental *Kalanchoe*. As I have already mentioned, it is not necessary that the plants should be exposed to appropriate day-length conditions throughout their whole life; usually exposure to appropriate conditions for a limited inductive period is sufficient, and they may afterwards be returned to non-inductive conditions, yet flowering will still occur.

If long-day plants kept under non-inductive short-day conditions are treated with GA they will proceed to form flowers in the normal way. This has been demonstrated with many species and appears to be a quite general response. There has been less experimental work reported with short-day plants, but with several species it has been shown that treatment with GA does not induce flowering in plants growing in non-inductive long-day photoperiods. On the contrary, it has been shown that *Kalanchoe* is prevented from flowering by GA, even if kept in inductive short-days. Though at first sight it may seem that GA acts differently on these two classes of plant there is really an underlying unity—in each case GA treatment produces the same effect as exposure to long-day conditions. In other words, it is simulating the effects of exposure to light.

Turning now to effects of temperature on flowering, I propose to mention only one requirement—the requirement of some species for exposure to low-temperature before flowering will occur. This is a characteristic requirement of biennials; such familiar plants as the foxglove and sugar-beet remain in the form of vegetative rosettes unless they are exposed to a period of low temperature, after which flower stalks and flowers are formed. The necessary low-temperature treatment is usually spoken of as *vernalization*. GA has been shown to induce flowering of cold-requiring biennials even if maintained throughout their life

at temperatures well above the critical temperature for vernalization. Thus GA in such cases is vernalization-simulating.

EFFECTS ON DORMANCY

Dormancy is frequently a characteristic feature of plant life. Under certain environmental conditions growth and development slow down or cease, and recommence only when exposed to appropriate environmental stimuli. Here again, light and temperature are of great importance. Such a physiological mechanism is of obvious adaptive value.

The simplest case is that of seeds; many seeds will not germinate unless exposed to light during the process of germination, or will not germinate or will produce abnormal stunted plants unless exposed to low temperature. Many lettuce seeds are light-sensitive; such seeds will germinate in complete darkness if treated with GA. Seeds of many plants of the order *Rosaceae* produce stunted plants unless 'after-ripened' at low temperature—this is particularly well shown by some species of peach and apple. GA treatment of some such seeds or of the stunted seedlings has been shown to enable the production of a normal seedling without the low-temperature treatment.

Vegetative development of many woody plants is frequently interrupted by periods of dormancy; we are all familiar with the dormancy of deciduous trees in winter. Such dormancy may in nature be associated with unfavourable length of day, or with a requirement for low-temperature vernalization. Again, examples are known where both these kinds of dormancy can be broken by GA treatment.

Dormancy is in some cases not obviously related to temperature or day-length. An example of such non-specific dormancy is that of the potato-tuber, which will not sprout for some weeks or months after lifting. This dormancy too can be broken by GA treatment. In fact, this effect of GA, described in 1955, was the first indication of its dormancy-breaking powers. You can therefore judge the interest being taken in GA when you realize that all the other dormancy-breaking effects mentioned above have been observed since then.

PRACTICAL APPLICATIONS OF GIBBERELLIC ACID

The Japanese workers obtained their gibberellins in fungal cultures in quantities of the order of 10–20 milligrams per litre of culture. My colleagues Mr. I. S. Nixon, Mr. E. G. Jefferys and Mr. A. Borrow have succeeded in developing methods for production of gibberellic acid by fermentation in yields of 1 gram per litre. Thus, although it must necessarily be an expensive product, it is now possible to produce relatively large quantities by fermentation. Since it appears to induce its characteristic effects on plant growth and development in very small doses, it is clearly not out of the question that it might prove of value in agricultural or horticultural practice. You will appreciate that much field experience is needed before its practical value can be properly assessed, and there has not yet been time for sufficient work of this kind. I can only, therefore, at this stage indicate possibilities.

The following physiological effects, among others, might conceivably be useful:

(*a*) increased dry weight;

(*b*) increased height of shoot;

(*c*) induction of flowering of long-day plants and biennials under otherwise unsuitable conditions;

(*d*) prevention or delay of flowering of short-day plants;

(*e*) breaking of dormancy and allied phenomena.

I shall briefly consider each of these possibilities in turn.

The first experimental work on the possibility of increasing dry weight of crop plants was that of Mr. D. C. Morgan and Dr. G. C. Mees at the Jealott's Hill Research Station of I.C.I. They found that though shoot growth was frequently enhanced by GA treatment, yields of that part of the plant normally harvested were not necessarily increased at harvest time. For instance, grain and straw yields of wheat and fruit yields of tomatoes, peas, runner beans and blackcurrants were not increased, in spite of enhanced vegetative growth of the plant during the growing season. The yield of some root crops was actually decreased. They did, however, obtain substantial increases in yield of grass. In trials in different parts of the country, over three seasons, where swards were treated with GA at 2 oz./acre, yield increases of 6–46 per cent were obtained from cuts taken 4–10 weeks later. The effect appeared to be most noticeable early or late in the season. However, though a substantial increase in yield can be obtained by such treatment, 2 oz. of gibberellic acid will always be costly by farming standards, and it seems doubtful if such a treatment would ever be economic unless the cost of production of GA could be drastically reduced. Moreover, second cuts from the same sward were usually of less weight than those from untreated swards, so that the effect of GA treatment is really to secure an earlier crop. This increased yield of grass following GA treatment has been confirmed in the United States. Taken as a whole these results suggest that GA treatment might have greatest potential values in marginal climates, for example, where the spring flush of growth is delayed. The only other crop where there is any sound evidence of yield increase is celery, but in this case the field experience is still too slight for a positive recommendation to be possible.

Increased height of shoot would often be disadvantageous, since increased height is usually associated with decreased mechanical stability. In the case of those plants where fibre is extracted from the stem, for example, flax or hemp, it might be a desirable effect. It is known that GA treatment will increase the height of flax and hemp plants, but I know of no investigations on the length and strength of fibre produced.

Induction of flowering of biennials in one year and of long-day plants under short-day conditions may well be of assistance in plant breeding and in commercial seed production. It may make possible the cultivation of some long-day plants in lower latitudes than has previously been possible, in cases where the

harvested crop is the fruit or seeds. The delaying effect on flowering of short-day plants may be of value in production of ornamentals for certain seasons. For instance, flowering of some varieties of chrysanthemum might be conveniently delayed until Christmas.

The advantages of breaking dormancy of seeds and tubers may seem obvious, but in fact, dormancy of such a kind rarely holds up cultural operations in practice. A more probable use of this property of GA may be to make it possible to grow cold-requiring plants in warmer climates, or to spread growth of plants which tend to become dormant in short-day conditions over longer seasons.

I have by no means covered all the possibilities of practical use of GA, but I hope I have given an adequate impression of the great amount of experimental work needed. The impression I wish to convey is two-sided. There seems to me no immediate large-scale practical use in sight but there are many varied possibilities, of a kind which have not previously existed, and these should be, and I have no doubt will be, vigorously investigated during the next few years.

THE MODE OF ACTION OF GIBBERELLIC ACID

I next wish to devote a little space to an account of some further developments of knowledge which have come about as a result of study of the effects of GA on plants, developments at the moment of great scientific interest only, but which may later lead to corresponding practical benefits.

Generally speaking, the main effects of GA on vegetative growth are based on increased cell extension. But it has for long been known that there are natural hormones in plants—the auxins—which, among other activities, regulate cell extension. The most well-known auxin is 3-indolylacetic acid. It is natural, therefore, to inquire whether GA increases cell extension in the same way that auxins do. In an attempt to answer this question, several workers have made various comparisons of the physiological response of plants to GA and to the auxins. It appears that in many ways they are similar; for instance, both induce cell extension and both induce parthenocarpic development of fruits. But there are also many differences between them: for example, auxins strongly inhibit root growth, but GA does not; IAA induces rooting of cuttings, whereas GA inhibits it; auxins do not have the characteristic dormancy-breaking properties of GA, nor do they induce flowering of plants in strictly non-inductive photoperiods. Of these effects the stimulation of cell-extension has been regarded as most diagnostic of auxin activity, but even here the auxins and GA differ: auxins have little effect on the cells of intact plants, whereas GA may have a great effect; contrarily, auxins greatly stimulate cell extension in isolated sections of young plant tissues, whereas GA has a comparatively small effect. Thus, the general impression obtained from this comparison is that GA and the auxins have distinct physiological effects on plants, in spite of some similarities. This view is strengthened by two further pieces of evidence. First, all auxins, whether natural or synthetic, have chemical structures similar in certain respects. A good deal of work has been done on the chemistry of gibberellic acid, and the structure tentatively proposed by my colleagues, Dr. B. E. Cross, Mr. J. F. Grove, Dr. J.

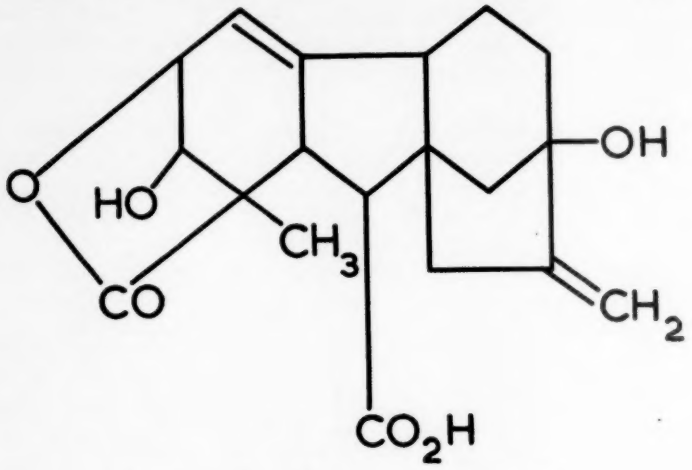


FIGURE 4. *Tentative structure of gibberellic acid*

MacMillan, and Dr. T. P. C. Mulholland (Figure 4) has been generally accepted. This is quite unlike any known auxin. Secondly, evidence is accumulating that GA only induces responses in plants if an auxin is present—the two kinds of substance are interdependent.

It might, then, seem surprising that a metabolic product of a fungus should so dramatically influence plant growth and development by a previously unsuspected mechanism, all the more surprising in that all the responses which it induces are essentially natural. It now appears that there is a reason for this. I mentioned earlier that some kinds of plant showed greater growth responses to GA than other plants. This differential response is shown most clearly in plant species which contain dwarf mutant varieties. It was first demonstrated with garden peas; dwarf varieties may grow four or five times taller if treated with GA, whereas tall varieties may scarcely respond at all. Moreover, the dwarf variety treated with GA becomes indistinguishable in vegetative characters from a genetically tall variety. A similar response by dwarf mutants of maize has been demonstrated by Dr. B. O. Phinney of the University of California, and it now appears that many dwarf mutants can be made to grow normally if treated with GA. Auxins have no such effect. A simple hypothesis which would account for this would be that plants normally produce a hormone with physiological properties similar to GA, and that the metabolic processes involved in this synthesis are in some way impaired in dwarf mutants.

The hypothesis has been put to experimental test by my colleague Miss Margaret Radley and by Dr. B. O. Phinney at the University of California. Both have produced evidence that hormones *physiologically* similar to GA are to be found in plants, particularly abundantly in certain immature seeds. This

observation has been carried a long way further by my colleagues Dr. J. MacMillan and Mr. P. J. Suter. They have concentrated the GA-like hormone from the seeds extracted from over a ton of runner beans and have succeeded in isolating and identifying gibberellin A_1, a dihydro-derivative of gibberellic acid. Thus, after all, the gibberellins are natural plant hormones, if I may argue from work on one plant species, and the extraordinary effect of a mould metabolite can be rationally accounted for.

I should like now to extrapolate speculatively on this basis. We have seen that in many of its effects on flowering and on dormancy, GA simulates the effects of light or of vernalization. Further examples of this could be cited. It has long been known that light and low temperatures induce their effects indirectly through a hormonal mechanism. Since we now know that the gibberellins are natural plant hormones, it seems plausible to suppose that light effects and vernalization effects are mediated by increased synthesis of gibberellins. Such a hypothesis is in many ways attractive; fortunately it can be experimentally tested without undue difficulty.

CONCLUDING REMARKS

You will now have seen how the simple observation made by the plant pathologist Kurosawa in 1926 has led to the discovery of a quite new class of plant growth-regulating compound, which may enable us, directly or indirectly, to secure a far greater degree of control over growth and development of crop plants. It has also led to the discovery of a new kind of natural hormone in plants, regulating growth and development, and may increase our understanding of the underlying biochemical mechanism of the phenomena of photoperiodism and dormancy. Before I conclude I should like to comment on two general features of the development of research on the gibberellins.

A new class of plant hormone, apparently widespread in plants, has been discovered as a result of a study of a mould metabolite. This is in itself quite remarkable, but it is in fact a case of history repeating itself. The plant hormones were known to exist long before they were isolated from plant tissues in quantities permitting chemical study. The discovery that indolylacetic acid had auxin-like properties derived from two sources: (*a*) the discovery of materials in human urine with auxin-like activity, culminating in the isolation of indolylacetic acid by Kögl, Haagen-Smit and Erxleben in 1934; (*b*) the even earlier discovery of auxin-like materials in fungal cultures by Nielsen in 1928, followed by identification of the active material as indolylacetic acid by Thimann in 1935. It was not until 1946 that indolylacetic acid was finally proved to be present in higher plant tissues. Thus the study of fungal metabolism has played a most important part in the discovery of two classes of plant-hormone—the auxins and the gibberellins.

It therefore seems remarkable that, though the presence of auxins in fungal cultures was established two years after Kurosawa's demonstration of the gibberellins, interest and knowledge of the gibberellins should have lagged so far behind. Why was it that to all intents and purposes during the years 1926–52

research on the gibberellins was confined to Japan? Doubtless language difficulties and the relative scientific isolation of Japan were partly responsible, but all the Japanese work, from Kurosawa's observations of 1926 to the isolation of an active material by Yabuta and Hayashi in 1939, was promptly abstracted in *Chemical Abstracts* and the *Review of Applied Mycology*. There certainly was a break in communication during the war years. There were no abstracts of Japanese work in *Chemical Abstracts* between 1941 and 1950. In the latter year no less than twelve Japanese papers were abstracted, covering the period 1940–44, and the position was brought up to date by the appearance of abstracts of five further Japanese papers in *Chemical Abstracts* for 1951.

I think that a more potent factor in preventing general appreciation of the Japanese work was a mental attitude among plant physiologists. The human mind usually prefers simple explanations of phenomena, and there was for several years a strong impression that all phenomena of growth and development could be explained in terms of the metabolism of one auxin, indolylacetic acid. In the early 1950s there began to accumulate various pieces of evidence that the growth-regulating system was in fact more complex, and it was probably the appearance of abstracts of the backlog of Japanese papers on gibberellin in 1950 and 1951, at a time when the mental climate was more responsive than it had previously been, that stimulated interest in the giberellins in this country and in the United States. I can claim no personal prescience in having become engaged in a study of the gibberellins earlier than most. It was Dr. W. A. Sexton of the Pharmaceuticals Division of I.C.I. who suggested to Jealott's Hill that the gibberellins might be worth examination as plant growth-regulators, and their inquiry prompted my colleagues and me at the Akers Research Laboratories, who had for some years been concerned with investigations of biologically active metabolic products of fungi, to take the first steps in the production and study of gibberellins in this country. It has been the most scientifically exciting work in which I have ever been involved, and I am glad to think that our efforts have contributed to the fact that ample supplies of gibberellic acid for plant physiological research are now available in all countries.

DISCUSSION

THE CHAIRMAN: I think everybody will have been struck by the astounding effects, particularly on dwarf sweet peas, of very small amounts of this material. I want to begin the discussion by taking issue with Dr. Brian on two points. In his last few remarks he disclaimed that he really did anything about this work at all—it was other people who suggested it to him, and so on. Well, I think we may perhaps allow that suggestions were made to him from the outside; but the skill with which he has investigated these is something which should be remembered, that and the remarkable results which he has achieved. He has made the very most of this particular line of work. One of the most exciting sides of this development has been the isolation from these peas, both dwarf ones, unfortunately, and tall ones, of gibberellin A.1. One of the questions which I want to ask him is whether, in fact, there is any difference in the amount of gibberellin A.1 when the things have been illuminated and kept in the dark, kept warm, and when they have been kept cold, because that, of course, is one of the striking effects on the induction of flowering. The other point on which

I want to take issue with him is when he says that this is one of the gifts, as it were, of mycologists to the plant physiologists. Whilst I am possibly in one sense labelled a plant physiologist, I think this separation of botanists into different categories is one of the rather unfortunate features of the segregation of the scientists. I should like to think of mycologists, plant physiologists and plant biochemists all being botanists of a type and not having to have too wide a rift between them.

One other point which I should like to raise concerns the question of dormancy. He rather implied that this was not of much agricultural importance. Now there is one practical aspect of dormancy which is attracting attention in other laboratories, particularly in connection with dormancy of certain parasitic seed. There is a very well-known tropical parasite, *Striga*, which is a very serious disease and is becoming even worse in the United States of America, where it has recently begun to spread. It is a parasitic flowering plant, attacking cereal crops. Material has been isolated which causes the germination of these seeds, and I believe that Professor Johnson of Nottingham has hints as to the structure of this germination-promoting substance. I therefore ask Dr. Brian: is anything known of a possible similarity between the gibberellins as dormancy breakers and the dormancy breaker for *Striga* seeds, and the suggestion that was made at one time that what broke the dormancy of *Striga* was a chemical compound rather similar to the thing which might be a potato eel-worm cyst-hatching factor? These dormancy breakers or hatching factors are in principle of very great agricultural importance, because if you can hatch all your eel-worm cysts from your potato lands and have no potatoes there for them to grow on, you may in fact be eliminating your disease-producing organism; and the same sort of thing applies to your *Striga* seeds. If by spraying your fields with a dormancy breaker of *Striga* seeds you make them all germinate and there is no host plant for them to grow on—well, you have got rid of a menace.

THE LECTURER: Of course, I agree with you about the undesirability of dividing microbiologists from plant physiologists. However, I thought I would make the point because in some people's minds there is this distinction, and what I really want to bring out is that this illustrates very clearly the fact that they are highly interconnected.

I am afraid the answer to all the other questions is, I do not know. Obviously, we must find out whether exposure to light or exposure to low temperatures affects the gibberellin content. So far as I know that work has not yet been done—if you ask me a couple of years hence we might be able to tell you. As to the effect on germination of things like *Striga*—again, the answer is, I do not know. It certainly occurred to me, and I obtained some *Striga* seed at one time to try to work this out, but I could not make the thing germinate any way. So I am still none the wiser. I have seen nothing else published, and clearly this is a point worth pursuing. The kind of substance that Professor Johnson described as a result of his work at Cambridge certainly seemed to be rather different from gibberellic acid, but it may turn out to be related.

DR. I. H. WILLIAMS (Wye College): We have been experimenting with gibberellic acid, and with other chemicals, in seeking a rapid method of breaking the dormancy of hop seeds. This would be of considerable help to the hop breeders. I have tried various concentrations of gibberellic acid without any success. Seed germinates readily after various physical treatments, such as a period of low temperatures or after chipping. I should like Dr. Brian's opinion as to the range we might concentrate on with this chemical, and whether he would advise soaking the seed in concentrated gibberellic acid for a short period or allowing the acid to remain with the seed throughout the treatment.

THE LECTURER: What I have said inevitably simplified things, almost to the extent of falsification on some occasions. It is true that gibberellic acid and the other

gibberellins have a fairly general effect on seed dormancy, but they do not reverse all kinds of dormancy. For instance, a number of compounds have been known to effect dormancy, things like cysteine; and the effect of gibberellic acid does not necessarily overlap the effects of such substances completely. It may be that you are dealing with a different kind of dormancy. As to the method of application, I am afraid that no general guidance can be given at all, you have just got to try it and see.

MR. J. C. F. HOPKINS (Commonwealth Mycological Institute): If I heard correctly, Dr. Brian said that *Gibberella fujikuroi* was the only fungus to produce substances of the type of gibberellin he has been describing to us. In Southern Africa, right through from Rhodesia down to the Union, there is a very common disease of *cynodon dactylon* in grass which produces a very similar effect. It is caused by a species of balansia, and the general effect is the elongation of the internode of these grasses so that you get tufts of shoots standing up wherever the grass grows, especially in the rainy season. It is very noticeable on golf courses. In fact, I think this is the only place where any real notice has been taken of this phenomenon. But I should like to know whether Dr. Brian is aware of this.

THE LECTURER: I was not aware of that particular instance. A number of diseases are known where you get internodal elongation of the same general kind that you get with the *bakanae* disease. A fairish proportion of the rather limited number of cases known are cases of infection by obligate parasites, which cannot be cultured, so that one cannot approach them experimentally at all easily. Of the remainder, I have looked at some and have found no evidence of production of gibberellins. The explanation which has usually been given to these effects has been that somehow or other the parasite is modifying the auxin metabolism of the host plant. The evidence for that point of view has at times been extremely inadequate. I think, nevertheless, it is probably true in some of these cases; so far, at all events, only *Gibberella fujikoroi* is known to produce metabolic products of this kind. There was a short paper in *Science* about a year ago describing an investigation of some 2,000 different species of fungi and actinomycetes, but none except *Gibberella fujikoroi* produced gibberellins. We have looked around in a much more modest way than that, but still with the same failure.

DR. I. N. ASHESHOV (Lister Institute of Preventive Medicine): Are the unicellular organisms like bacteria actinomycetes and fungi affected by gibberellic acid?

THE LECTURER: In my experience, and backed by that of other people, there is no effect whatsoever on fungi or bacteria. Now you might think there would be an effect on a unicellular algae perhaps, but so far as I know the only one which has been investigated is *Chlorella*, and there is no effect. So far as I know at the moment the only kind of plants which are affected in any way are flowering plants, ferns and mosses.

DR. H. J. BARBER (Research Controller, May & Baker Ltd.): Has gibberellic acid any pharmacological effects? I have it in mind that the acetylcholine could have been a contribution from the mycologist to the physiologist, but in fact it wasn't.

THE LECTURER: Thank you for this support. So far as I know there are no pharmacological effects. Of course, that is a matter receiving attention in many quarters, but there is certainly nothing dramatic.

DR. DAPHNE J. OSBORNE (Department of Agriculture, Oxford): Dr. Brian suggested that perhaps in certain ways gibberellic acid has an effect on plants which is similar to that induced by light. I am very curious to know what happens when gibberellic acid is applied to tall and dwarf pea plants grown in the dark—does it then retard growth?

THE LECTURER: Well here again I have been simplifying things almost to the point of falsification. As you know, the effects of light on plants are not by any means uniform, that is to say there is a number of distinct effects. Light promotes flowering, it promotes growth in certain cases, but also, as you are suggesting, it inhibits some forms of growth in that plants grown in darkness are frequently very much taller and have elongated internodes. Under conditions of darkness gibberellic acid I think almost always has less effect than it has in light. It does not necessarily, however, have no effect. You can still distinguish between tall and dwarf varieties of pea even under both circumstances. If grown in darkness, the difference between a tall pea and a dwarf pea is much less than it is in light, but it still is there. Some people have suggested that the gibberellic acid reverses the growth-inhibiting effect of light. In a sense it produces the same effect as etiolation, but I do not really think that that is strictly true if you look into it at all carefully, though certainly in this instance darkness and gibberellic acid have certain similarities.

MR. G. K. GRAHAM CAMPBELL (Plant Breeding Institute, Cambridge): Can the treatment of potatoes be effective in breaking dormancy some months after harvesting?

THE LECTURER: I could not say. My experience has been limited, and the published American work I have seen has been limited. Certainly, though, treating King Edwards within a week of lifting, and at periods of, I should think, up to two months after that, would still induce the sprouting. But as I said earlier, the sprouts that are induced are highly abnormal, they are very thin and spidery and I would not care to use potatoes like that for seed myself.

DR. JOHN K. SPEARING (Sir John Cass College): May I ask Dr. Brian whether gibberellic acid has a marked effect on the mitotic cycle?

THE LECTURER: Well this point is still a little obscure. In the case of internode extensions it apparently does so by increasing cell extensions. However, in the case of the Cupid sweet pea, where essentially the effect is to ensure continued growth of but one axis, that is to say, continued activity of the apical meristem, there it is having an effect on cell division; precisely of what kind I do not know, but at all events it is stopping certain processes which would normally stop that cell division. In the case of the *Hyoscyamus*, the biennial, where you turn a rosette plant with virtually no stem at all into one with a very big stem, Lang and his collaborators in California have produced, I think, pretty reasonable evidence that what happens first is that you get a stimulation of cell division at the apical meristem. The distinction between its effects on cell division and cell extension is by no means clear.

MR. L. JONES (Grassland Research Institute, Hurley): Could Dr. Brian throw a little more light on why one should get a decrease in the second cut when gibberellic acid was applied to grass? And secondly, has gibberellic acid had any appreciable effect on the growth of dwarf rygegrass mutants?

THE LECTURER: To take the second point first: there has been some work done, which I have been privileged to see before publication, at the Plant Breeding Station in Wales, with certain dwarf mutants of ryegrass, where normal growth in this dwarf mutant has been induced by treatment with gibberellic acid.

Now your first question was to ask why you get the loss of the second cut. I do not really know—it is a complex phenomenon. A fairly characteristic effect of gibberellic acid on grasses and cereals is one I have already mentioned: that you get increased apical dominance, and consequently there is less tillering, so that if your second crop after your first cut is due to new tillers the gibberellic acid treatment inevitably reduces yield. Also more growing points get lifted up in the path of your mowing machine, and more damage to the plant would occur as a result of cutting. I think

that this secondary decrease is probably quite complex, due to several factors, but I do not think any really close analysis of the situation has yet been made. In fact, it is only too true that very much of the work on gibberellins so far has been pretty anecdotal.

MISS O. R. DEWEY (Fisons Pest Control Ltd.): Does gibberellic acid have any persisting effect in soils?

THE LECTURER: It is certainly not at all persistent in soil. There is fairly reasonable qualitative evidence that the loss in soil is to a considerable extent due to microbial breakdown. It does not appear to be stable in the plant. The effect of a single dose on the growth of a pea plant is evanescent. A dose of a hundredth of a microgram will produce an effect only for a matter of a week, whereas a microgram may continue to produce an effect for much longer. But then one cannot be quite sure whether the continued effect is due to a persistence of the material or to its having triggered off something.

DR. C. H. FAWCETT (Wye College): I wonder if Dr. Brian could tell us a little more about that experiment where he extracted tall pea plants and dwarf pea plants, and then put the extract on the dwarfs. Could he indicate the number of plants that were extracted to provide an extract to go on the dwarfs?

THE LECTURER: I cannot give you exact figures, but it is a large number: something of the order of one hundred plants to produce an effect on one. You can find this material in the upper part of the stem, in the lower part of the stem, in upper leaves, in lower leaves; you can find it even in the root; and the only difference between talls and dwarfs is in the upper extending part of the stem, where it is apparently true that in the tall you can get about three or four times as much as you can out of the dwarf. If one were to envisage extracting enough out of pea shoots for chemical identification it would be a horrible prospect.

MR. D. SEFTON: We have seen the effect on dwarf peas. Have seeds been collected from such plants, and do they produce normal dwarf plants in turn, or is there any increase?

THE LECTURER: Yes, we have done that, and seeds from dwarf plants treated with gibberellic acid produce only normal dwarf plants.

THE CHAIRMAN: I am not sure that Dr. Osborne was quite satisfied with the answer she received to her question. I do not think I was, either. If you have a tall pea grown in darkness with gibberellic acid does it grow the same size as tall peas kept in light?

THE LECTURER: I will try to make this a little clearer. A tall pea grown in darkness does not grow very much taller than a tall pea in light, though it does to some extent. A dwarf pea grown in darkness grows a lot taller than it does in light, but there is still a difference between it and the tall pea. Apply gibberellic acid in darkness or light to the tall pea and it has no effect. If you apply it to the dwarf, it has a big effect in light but a small, though still definite, effect in darkness.

THE CHAIRMAN: Dr. Osborne was perhaps hoping that the effect of gibberellic acid in darkness would be to make the tall pea grow smaller than it otherwise would do.

Well, I think we have subjected Dr. Brian to an adequate cross-examination! We have been told about what I think all of us will agree is one of the most exciting developments that has appeared in the last 20 or 30 years. From 1926 or thereabouts till the present day we have learned practically nothing about how auxins work, and the birth of the gibberellic acid era I suppose begins about 1952, so it is

still very much in its infancy; and we look forward to hearing again from Dr. Brian, perhaps in five years' time, or in two years, of even more exciting developments. I ask all of you to thank Dr. Brian for his fascinating lecture.

The vote of thanks to the Lecturer was carried with acclamation.

SIR WILLIAM OGG (A Member of Council of the Society and Director, Rothamsted Experimental Station): May I on behalf of the Council of the Royal Society of Arts express our very warm thanks to Professor Bennet-Clark for presiding at this extremely interesting lecture of Dr. Brian's? It was particularly appropriate to have in the Chair to-day one of the leading botanists in this country. Besides, Professor Bennet-Clark has strong agricultural interests and is a member of the Agricultural Research Council, and I venture to hope that gibberellic acid has aroused interest in agricultural research circles, and that they will learn something from this new material. I am sure you will agree that Professor Bennet-Clark has conducted this meeting admirably. I should also like to express our appreciation to Plant Protection Ltd., the firm that endowed these Fernhurst Lectures. They did so from purely altruistic motives, and we have had a series of very fascinating lectures as a result. The size of the audience this afternoon is an indication of how much they are appreciated. This Society, I would remind you, in its early days had a very keen interest in promoting agricultural investigation and improvement, and the Fernhurst lectures are carrying on that early tradition.

The vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.

THE UNIVERSITY OF MALAYA

The Thomas Holland Memorial Lecture by

SIR SYDNEY CAINE, K.C.M.G.,

Director, London School of Economics and Political Science, delivered to the Commonwealth Section of the Society on Thursday, 13th February, 1958, with His Excellency Dato Nik Kamil, C.B.E., High Commissioner for Malaya in the United Kingdom, in the Chair

THE CHAIRMAN: As one of those who have been closely associated with the establishment of the University of Malaya, and as a former member of its Council, I should like to take this opportunity of paying tribute to Sir Sydney Caine for the contribution he has made towards the development and growth of this institution as its Vice-Chancellor from 1952–6. He came to the university with a vast store of experience in the fields of administration and finance, and his personal reputation in the academic world gave the university the high standing it now enjoys. I am rather proud of the fact that it was during Sir Sydney's term of office as Vice-Chancellor that the honorary degree of Doctor of Laws was conferred on me by the University of Malaya.

Sir Sydney's interest in Malaya has not diminished since he left the country. Even now he is assisting us in training ten external affairs officers at the London School of Economics. Inasmuch as the University of Malaya is the source to which we look for our national leaders and administrators, teachers and doctors, Sir Sydney has done a great deal to foster the healthy growth of our new Malayan Federation. It is particularly significant that under his leadership the University has been the nursery of a genuine patriotism, based on the unity of the various races and groups which make up the population of Malaya. It has been very encouraging that in spite of the disproportionate ratio between these various groups within the University, as compared to the ratio in the population, there has been such a degree of interracial harmony as to be an example to the whole nation—and for this Sir Sydney must be given his fair share of credit.

The following lecture was then delivered:

THE LECTURE

I am here to give a lecture on the University of Malaya; but there is not only one lecture I would like to give, there are half a dozen. I could devote one lecture to its physical situation and background, another to its human material, the student population, a third to its history, a fourth to its cultural and political setting, a fifth to its academic status, and so on. What I have thought it best to do is to try to give you an idea of its physical background and of its students and teachers by showing a film made specially of it; and to speak in my own

lecture of its cultural and political background, of its origins and development, and of some of its special features and problems.

The University, now in its ninth year of existence, was dreamt of long ago. Stamford Raffles, when he founded Singapore over a century ago, saw it as a great meeting place of East and West, and his vision of the great city which was to grow up included not only great docks and warehouses but a university and other centres of learning and culture. How true was that vision of Malaya as a meeting place not only of trade and shipping, but also of cultures, is apparent if we turn to consider the region in which it lies.

The Malay Peninsula and Singapore lie well within the region which has come to be known as South-East Asia, stretching from Burma and Indo-China to Java and the Moluccas. It is a region almost wholly tropical, a region of heat and high rainfall, containing many large islands and archipelagoes, and with its mainland areas so cut up by mountains that its populous river valleys constitute almost another series of islands. It lies at a great junction of communications between India to the West, and China to the East, and between the vast bulk of Asia to the North and Australia to the South. Singapore, lying just at the southernmost tip of the Asian mainland, is a natural calling place for ships moving between the Indian Ocean and the Pacific, and a centre of trade. South-East Asia has for long been a source of natural products in demand all over the world; spices at one time and later cinchona, tin and rubber. Trade and communications have therefore given it widely ramifying contacts with other countries.

No record remains of any entirely indigenous civilization having ever risen in this area. It has contained great centres of population and art time and time again in past centuries, but they have always drawn their inspiration from elsewhere, from India or China, or farther afield. The ease of sea communications has made the area specially susceptible to influence by oceanic powers. Some six hundred years ago there came such an impact from the Arab world, and large parts of the area, including Malaya itself, adopted the Muslim religion. Later, and especially in the last few generations, there has been an increasing impact from Europe, and most recently from America and Australia. It is therefore, as much as any area in the world, a region of cultural mixture.

This characteristic of cultural mixture reaches its height in Malaya. There the Malay or Muslim element constitutes the basic or indigenous population, but peoples of other races have come into the country in large numbers, especially in the last hundred years. To-day Chinese and Indians are together slightly more numerous and much more active commercially than the Malays, while the English element, although nothing like as numerous, has been of crucial significance in the establishment of political and economic order in the last few generations. There has not been time for all the immigrant peoples to be wholly assimilated to a common local culture, and it remains one of the great issues whether local loyalties can be built up powerful enough to withstand the strong attraction of external attachments.

Here let me digress a moment to say that in thinking of possible rival loyalties

I am not thinking of the conventional 'Communist' and 'non-Communist', but of what I believe to be the deeper-lying differences between those whose basic thinking is Muslim or Chinese or Hindu, as the case may be.

In 1949 when the University was founded, mainland Malaya was organized as a federation of nine Malay States and two bits of British territory. Each of the Malay States had its own ruler and its distinct sovereignty, but was in treaty relation with the United Kingdom on terms which gave the United Kingdom, as the protecting government, the control of foreign policy, and an overall supervision of internal administration. The two small areas of British territory were Penang and Malacca, which before 1945 formed with Singapore the Colony of the Straits Settlements. Singapore itself remained as a separate British possession—a small island containing a great port and city and a million people.

The Federation was, of course, vastly greater than Singapore in physical area and substantially larger in population, being at that time about five and a half million to Singapore's one million, but education was more advanced in Singapore, so that at the initiation of the University nearly two-fifths of the students came from Singapore. I have already spoken of the mixture of races in Malaya; taking the mainland and Singapore together, out of every 100 people 45 are Malays, 45 are Chinese, 9 are Indian or Ceylonese, and one is Eurasian, European or of other origin. The racial distribution is, however, markedly different in Singapore and in the Federation. In Singapore, Chinese people greatly outnumber all other races, forming nearly 80 per cent of the total. In some individual Malay States the Malays have an equal preponderance, and in the Federation as a whole the Malays amount to very nearly half the total population. Many of the Chinese and Indians were born outside Malaya or are the children of immigrants; and the same is true of a smaller number of Malays who have come in from Java or Sumatra.

Politically the shock of the Japanese occupation and various political changes made after the return of British control had left behind a considerable political ferment. It was taken for granted that in due course Malaya would become self-governing, but there was first of all a Communist terrorist campaign to master, and most people who thought about a date for political independence would have fixed it much later than 1957, when in the event it did come about. It was also commonly assumed that in one fashion or another Singapore and the mainland area would come together in a single political entity.

The University was thus conceived on the one hand as part of the somewhat gradual preliminaries to eventual self-government, and an essential contribution to the training up of the future local administrators and technicians who would eventually take over the running of the country from the British; and on the other hand as one among various institutions which would operate to unify the two divisions into which Malaya then fell and in due course become a joint institution of a single political organization.

Like many of the newer universities in this country, the University of Malaya grew out of earlier institutions founded with less ambitious scope. Following

a not unfamiliar pattern, the first institution of higher education in Malaya had been a medical school. Originally founded in 1905 and reconstituted a few years later as the King Edward VII College of Medicine, the medical school in Singapore had successfully established its status by 1915, when its diplomas were recognized for purposes of medical registration by the British Medical Council, and was already the main source of recruits to the medical profession in Malaya. Nearly a generation later, in 1928, a second college of higher education was opened in Singapore under the name of Raffles College. It aimed at giving an education at something a little lower than ordinary university standards in arts and science. Within a few years the possibility of transforming these institutions into a university was being discussed, but it was not until after the war that definite action became possible.

The authorities in London were then taking a general look at university education in the colonial empire. There was a general review by the Asquith Commission, and part of the Colonial Development and Welfare funds were set aside for higher education. A special committee under the chairmanship of Sir Alexander Carr-Saunders examined the situation in Malaya in 1947 and reported that it was satisfied that the standards achieved by Raffles College and the Medical College made it possible to create at once an independent University of Malaya instead of going through the intermediate stage of a University College working for special London degrees and in special relation with the University of London, as was at the same time planned for various territories in Africa and in the West Indies. Following legislation passed simultaneously in the Federation and Singapore, the University came into existence on 7th October, 1949.

From the first the University has depended for its income primarily on Government grants, the Federation and Singapore Governments accepting as a joint liability the meeting of running costs, which now approach £1,000,000 a year. For capital the University has looked to private donations and help from the United Kingdom under the C.D. & W. system as well as to the local Governments. The C.D. & W. contribution, originally fixed at £1,000,000, and later increased to £1,500,000, has provided about a third of the money spent or committed on capital construction so far. The pattern of government of the University was framed largely with an eye to the constitution of the provincial or city universities of this country, with academic matters in the hands of a Senate composed entirely of members of the teaching staff, and financial and general administrative control in the hands of a Council with both academic and lay representatives.

When it began, the University had faculties of arts, science and medicine, and a total student enrolment of about 450. The medical faculty included teaching for a degree in dentistry and a diploma in pharmacy; the faculty of science covered zoology and botany as well as mathematics, physics and chemistry; and the faculty of arts included economics along with English, history and geography. It was contemplated that among other early developments would be teaching departments in the principal local languages, that is Malay, Chinese

and Tamil. It would be tiresome to go through the history of all the developments which have since taken place. It is enough to say that between 1949 and 1957 the University has created departments in those languages, in philosophy, geology, engineering, law, and various additional medical subjects including parasitology, orthopædic surgery, social medicine and pharmacy at degree level. I understand that a new department of public administration is opening shortly, and that will in due course lead to the establishment of a separate degree in economics and politics distinct from the present general arts degree. In addition, the University has developed various diplomas in social administration, in education and in public health, and has many postgraduate students working for masters' or doctors' degrees.

In numbers also the development has been considerable. The Carr-Saunders Committee proved to be much too cautious in their estimates of growth. They thought that after ten years the University might have rather more than doubled its opening numbers and achieved an enrolment of 1,000. In fact, last October, after eight years, the numbers on the books totalled over 1,900. I do not want to bore you with too many figures, but it will give a little idea of the general character of the student body if I say that there were then 844 classified under arts, 227 science, 493 medicine, 109 dentistry, 18 pharmacy, 92 engineering, and 42 law. Of the total over 400, or about 22 per cent, were women. About one-third came from Singapore and nearly all the rest from the Federation, with a handful from the British Borneo territories. In racial composition Chinese preponderated with 63 per cent of the total, against only 12 per cent Malays and some 20 per cent Indians and Ceylonese. In mentioning those figures I should emphasize that the student body has shown a most admirable resistance to any tendency to divide on racial grounds. There is complete mixing and a very real pan-Malayan consciousness amongst them.

Until the current session the University was housed principally in the pre-existing buildings of the two former colleges. The Medical Faculty has its buildings adjoining the large and remarkably well-equipped Singapore General Hospital, while the other Faculties, plus the general administrative offices, are centred on the old Raffles College site, four miles from the centre of Singapore but still well within the urban area. There have been additions to the old college buildings, especially provision of hostels or halls of residence for students, for the great majority of whom residential accommodation is provided; and a good deal more building has been started in the last year or so—more halls of residence, laboratories, a new great hall and administrative offices. In this current session the University has commenced activities in a sort of branch establishment in Kuala Lumpur, the capital of Malaya proper, but I will say more about that later on.

All that I have been saying is dry and factual, lists of subjects, statistics and dates. I have not the gift to paint for you in words the physical background and the human life of the University. I hope that the film I have already mentioned will do something of that and give you a picture of the mixture of people among the students, of the way they live in their hostels and work in their laboratories

and lecture rooms, and of the buildings and the trees in which they are set. But neither statistics nor pictures can tell you everything about the academic spirit of the University; and I have time to say but one or two things of it. First, its aspirations are those of a university born in the British tradition; to teach its students not only knowledge but a love of knowledge; to add itself to knowledge by the research of staff and students; and to judge all its members not by race or origin but by academic attainment. It has aimed at the standards of the universities of this country; and the willing acceptance of its honours graduates for higher studies here is evidence that it is achieving that aim. It aims, too, at wider influence and wider contribution to public life than simply turning out men and women with degrees. It offers an increasing number of public lectures to the general citizen; it provides hospitality and a meeting place for conferences and vacation courses; it has created its own Art Museum as a contribution to local culture; it has established relations of affiliation with a new Muslim College for Islamic Studies. In sum, it is expanding and growing in many fields of cultivation of the mind, exactly as a university should.

But it also has special features and problems, and I want to turn to those. There are academic and research features arising from the tropical background, for example, special problems of research in the medical field, or opportunities of study of equatorial marine fauna, which are probably unparalleled anywhere else in the world. The special features I want to speak of are, however, those which arise from the rapid development, past and prospective, of the country, and from its cultural mixture.

As an economic and political entity, Malaya is a product of the last three generations. The ports and trading centres of Singapore and Penang are a little older, but the industries which have produced the wealth of the mainland, that is, tin mining in its modern form, and rubber, grew up within living memory. On these foundations of the primary industries of the mainland and the trading activities of the ports, immigrants have been attracted in large numbers from China, India and the neighbouring islands, and there has been built up a material prosperity unrivalled in Southern Asia. Until the last decade or so political growth had lagged behind, although it has now caught up very rapidly. Democratically elected legislatures were created only after the war, but to-day the mainland of Malaya is a fully independent member of the Commonwealth, and Singapore enjoys complete internal self-government. Local people are taking over control in all branches of government, the day of the British ruling class is completely over, and the remaining British experts and technicians are rapidly giving place to local people. It is the consequences of this rapid political change which create problems for the University. Most of them are not problems peculiar to Malaya, but have arisen, or will arise, as the same changes take place elsewhere.

First, however, there is a special feature of a local character arising from the political separation between Malaya proper and Singapore. As it was the common expectation ten years ago that the two would fairly quickly merge, the University was conceived as serving a single nation only temporarily divided; but things

have not moved that way. The mainland has attained its full independence while leaving Singapore at a half-way stage, and the present Government in Malaya has very clearly indicated that it has no present desire for union. It is symptomatic that active discussion is going on about the possible division of other joint institutions or working arrangements, e.g., the possible substitution of two monetary authorities for the existing monetary union, and the breaking up of an existing joint income tax department.

When the University was founded it was hoped that it would soon move to new buildings on a new site, on the mainland but only a few miles from Singapore. That project did not mature, partly for financial and practical reasons which in any case would have been conclusive, but also because it became more and more obvious that neither political unit would be content with a university situated wholly within the borders of the other. Accordingly I myself made the proposal, which was fairly quickly agreed in principle, that the University should establish itself in two divisions, one as at present in Singapore and one at Kuala Lumpur, the Federation capital. I had in mind that the rapidly growing population of the country, likely to be over ten million before the end of the 1960s, will quite soon need more than one university, and that university establishments at the two natural centres would pave the way for two fully fledged and separate universities in future generations. This plan for development in Kuala Lumpur moved slowly to begin with, and it was not until 1956 that a site was finally allocated and serious planning of buildings began.

Before the end of 1956, however, the changing political sentiment showed itself much as I had anticipated. The Government in Kuala Lumpur, looking forward to independence in the summer of 1957, appealed urgently to the University to start teaching activities in Kuala Lumpur at once, and in emergency buildings. The University responded to this appeal and began general first-year teaching in the current session. Among special developments contemplated at or near Kuala Lumpur is the creation of a Faculty of Agriculture; but the great importance of the development lies in the establishment in this way of the embryo of an independent university on the mainland. For the present a single authority is expected to remain in academic control of the two divisions, but a committee which examined the administration of the University last year has recommended the definite establishment of distinct organs of administration and financial control for the Singapore and Kuala Lumpur divisions.

The next and more typical problem arising from the particular stage of political development in which Malaya now stands affects the personnel of the University. Inevitably, since education as a whole had been comparatively backward, it was initially impossible to staff the University with teachers of local origin. Most of the teachers were drawn from outside Malaya, principally from the United Kingdom, but also from many other places, from China and India and nearly a score of other countries in Europe, America, Asia and Australasia, so that the University has perhaps as cosmopolitan a staff as could be found anywhere. The staff of local origin, principally products of the University itself or its predecessor colleges, is of course increasing in numbers, but the proportion of

local to total staff is increasing less fast because the rapid growth of the University, especially in new departments such as engineering and law, depends on new appointments from overseas.

This state of affairs has not proved entirely palatable to the new and vigorous national self-consciousness of the country, and there has been a widespread tendency to assume that just as local people are taking over from expatriates in Government and in business, so they should rapidly take over in the University. This has created additional strains, with the local people associated with the government of the University tending to look suspiciously on outside appointments, while at the same time pressing for the production of more and more graduates to fill senior posts in the future; and the academic side looking possibly too much to established standards of qualification as judged by external—that is non-Malayan—criteria. Short-term appointments for people from outside have offered one way out, but in general these factors, with their implications of insecurity, have made recruitment increasingly difficult.

Thirdly, local public opinion, in its new national self-consciousness, is inevitably impatient for the creation of a fully comprehensive university covering all the many varied forms of higher liberal and technical education. Courses in engineering, in law, in agriculture and so on, are demanded at a time when, to the more conservative academics, the first need is still to consolidate standards in the basic subjects of arts and science. Of course, these things must start at some stage and must grow, but we have been used in this country and in other Western countries to a more gradual development. Inevitably, therefore, there is great pressure on the administration, constant demands for additional finance, and perhaps a fair number of mistakes in the experimental early stages of new developments.

Lastly, and very considerably complicating these problems of forced growth, are great underlying problems of basic culture. I have stressed the mixture of cultural, racial and linguistic elements in the Malayan complex. In the end the true viability of the new Malayan nation and of the larger political system which includes Singapore depends on a fusing of those elements into a new culture which can provide the psychological or spiritual basis of political unity. It is a hard task with so equal a conjunction of such sharply differing basic attitudes as those of the Muslim Malayan, the half-Confucian, half-Communist Chinese, the Hindu Tamil and the partly Westernized, partly uprooted individuals of all racial origins. At the same time it is an urgent task because the influences of the connected outside cultures are close at hand and very likely to increase. Ideally it is a field where the University might play a very great part—given time. But universities need quite a lot of time to exert their full influence and they in turn need some firm basis of culture to work on. It is simple to talk of a synthesis of cultures, but I believe that all successful universities have, in fact, had some main cultural basis and have not tried to start from two or three co-equal but quite different bases.

These cultural problems are most clearly exemplified in the local problems of language. The three main vernacular languages in Malaya are Malay itself,

Chinese and Tamil, but other Indian languages are used, and half a dozen dialects of spoken, as distinct from written, Chinese. Primary education has been in Malay, Chinese and Tamil as well as in English, but the medium of secondary education has been only English or Chinese—English in the Government and mission schools, and Chinese in a number of schools organized and for long wholly supported by private Chinese initiative. The University of Malaya has used English as its medium of instruction, and has looked mainly to the English secondary schools for its students. Admission to the University has not been impossible for boys and girls from the higher classes of the Chinese schools, where they do learn a certain amount of English, but undoubtedly it is harder for them. In any case far fewer emerge from those schools at a level corresponding to our university entrance than from the English schools.

Nonetheless, because a certain number of young people could not in practice gain admission to the local university, and after the establishment of the Communist régime in China could not easily go to Chinese-speaking universities there, there developed a move among the Chinese community to establish a separate Chinese university in Singapore, and it came to birth and started teaching in 1956. It still remains to be seen precisely what standards it will attain and what will be its relations with the University of Malaya. I personally regret that it was not possible to work out arrangements for students whose first education had been in Chinese to find admission to the national university, but there were difficulties of various kinds. There was, perhaps, a certain slowness in facing the problem by the University of Malaya itself. Among some, at least, of the most influential members of the Chinese community there was an emotional desire to have an institution of higher education under entirely Chinese control, strengthened both by the local tradition which had left much of the provision of Chinese education to the Chinese and by the growing prestige of China proper under Communist leadership. And the Malay people and the Government of Malaya itself were reluctant to support any arrangement which would have increased still further the Chinese preponderance in the University of Malaya with no immediate prospect of parallel arrangements for Malay-speakers.

This problem of relations with the Chinese educational system is only a special aspect of a more general technical problem. Here we have in Malaya the mass of the population speaking a vernacular language or languages, while for practical reasons the highest level of education is conducted in a language foreign to the country. Malay, the official language of the main political unit, has at present neither the vocabulary nor the published literature to qualify as an adequate medium for university instruction, but English is still known to only a small minority. At some point in the educational pyramid a bridge has to be built between the vernacular and English, but in the end one must look to some more fundamental unification of language throughout the educational system. Malaya's special difficulty lies in the existence of at least three principal vernaculars. I cannot really believe in a bi-lingual or tri-lingual basis for efficient university teaching, and probably the University of Malaya itself will continue to use English for longer than might be the case if there were one single national

language as an alternative. But behind this technical problem lies the fundamental need to harness a cultural unity or at least a stable *modus vivendi* of cultures.

The picture I have tried to paint is of a university in a state of rapid growth and already beginning to form the nucleus of a daughter University, but at the same time struggling with difficult and perplexing problems arising from the rapidity of political development as well as out of the complex cultural background of the whole region in which Malaya is set. I hope I have not conveyed any impression, in speaking of the problems, that the University is in any danger of decline; on the contrary, I believe it is extremely vigorous and will go on growing rapidly in numbers and in the extent of its academic cover. Looking at it from the point of view of the whole cultural background, there are two further thoughts I should like to end with. First, I remember a distinguished visitor speaking at a Convocation of the University, making a comparison between its situation and that of ancient Alexandria. It is perhaps ambitious to think of a university sited in Singapore attaining the eminence which Alexandria once had, but it does have great opportunities as a centre of teaching and research because of the manifold economic and cultural connections which South-East Asia, and especially Singapore, has with all parts of the world. Without laying too much stress on that vague concept, the synthesis of cultures, there are great opportunities of comparative study and of the extraction of the best of many cultures, providing always that activities are not directed too much to purely nationalistic endeavours to maintain and fossilize individual national cultures.

Secondly, the University represents a part of the impact of the West on Malaya. Like the university institutions sited in other parts of the British colonial empire after the war, it was a perhaps belated attempt to carry across the seas British and Western ideals of education as well as British ideals of law and order and commercial development. I hope I shall not be condemned as an old-fashioned Imperialist if I say that do I believe that we have something to contribute in the field of higher education as well as in other fields of the mind and the spirit. By 'we' I mean not just this country, but the whole complex of Western civilization with its many strands of tradition going back to early Christianity, the great Greek thinkers and all the other influences of our modern culture. The University of Malaya will not develop in its new national setting exactly like a British institution, but if it serves not only to provide both a technical and humanistic education for the local people, but at the same time to preserve some of the best of the influences of Britain and Europe in this vast cultural complex, it will have been worth the effort put into its founding and early growth.

The lecture was followed by a showing of the film Malayan University.

DISCUSSION

SIR SELWYN SELWYN-CLARKE, K.B.E., C.M.G., M.C. (Chairman, Commonwealth Section Committee): Sir Sydney Caine mentioned that the General Medical Council had first recognized a diploma for a licence in medicine and surgery in 1915, in the time of the King Edward VII Memorial College, and subsequently, I believe about the year 1949, it had recognized the degrees of M.B., B.S., and M.D., M.S., granted

by the University of Malaya. I suggest that that is a very remarkable academic advance. I say this with some authority, because I was examiner in the final medical examinations in Singapore in 1930 and 1931; and, yesterday, I learnt that the President of the General Medical Council had returned recently from a visit to the University of Malaya and was completely satisfied with the high standard that had been attained in the Medical Faculty.

Sir Sydney also referred to the existence of a pan-Malayan consciousness in the student body, and the Chairman underlined that in his speech. May I join with the Chairman in congratulating Sir Sydney and his former colleagues for having inspired that consciousness, particularly because we are all aware of the difficulties that have arisen in regard, for example, to the Chinese schools in Singapore and to monetary and income tax matters. To have fostered a pan-Malayan consciousness is a very real achievement under those circumstances.

It was very interesting to learn that, although English is used as the general medium of instruction in the University of Malaya, teaching in Malay, Chinese and Tamil is already being given in engineering, law and some other subjects. I should like to ask the lecturer two questions. First, if teaching in Chinese had been provided, so as to enable pupils from Chinese secondary schools to enter the University of Malaya, would it have been possible to eliminate the urge for the foundation of Nanyang University in 1956? Secondly, does Sir Sydney feel that a possible solution to this language difficulty might be for the University in Kuala Lumpur to teach in English and Malay, and that in Singapore to teach in English and Mandarin or the prevailing Chinese dialect? There is a parallel for this. Some years ago I had to visit Johannesburg, and there, as you probably know, the teaching is in English and in Afrikaans. It was an impressive experience for me, sitting at a table with my medical colleagues, to hear them switch from English to Afrikaans without any difficulty at all.

THE LECTURER: It is difficult to answer the first of those questions because it involves guessing what would have happened in other circumstances. I think that if it had at first been possible for students from Chinese schools to gain admission to the University of Malaya (either by means of special instruction through the medium of the Chinese language at the University, or, more economically, by putting the students through an intensive course in English before they were admitted) it would have weakened the case for a separate Chinese university. But I do not believe it would have completely removed all the motives of those who advocated it. I am sure that there were some people who advocated such a university because they wanted a Chinese university in a different sense; that is, a university under Chinese control.

On the second question, as to whether we could meet the language difficulty by the development of two bilingual universities—I think that is possible and is on the whole quite likely to happen. I believe that the half which functions in Singapore will tend to use more and more Chinese, and the half that functions in Kuala Lumpur will tend to use more and more Malay. But substantial difficulties remain. For a considerable time to come the medical school will be in Singapore, and therefore the Malays who want to obtain a medical education will not be able to use Malay; and there are other things which are likely to develop only in Kuala Lumpur. There is also the risk that such a solution to the language problem would tend to widen the gulf between Kuala Lumpur and Singapore.

LADY MOORE-GUGGISBERG, C.B.E.: I should like to ask whether many girls take places in the university?

THE LECTURER: Yes, many do. About 400 out of the existing number of about 1,900 are girls, which is quite a respectable proportion. The proportion of men to women is not so very different from that in Western universities.

MR. CHUA SIAN CHIN: I should like to ask Sir Sydney whether he agrees with the view recommended by the recent five-man Commission on the University of Malaya (headed by the Vice-Chancellor of Birmingham University), that there should be only one University of Malaya, with university colleges in Kuala Lumpur and Singapore, and later on incorporating the Nanyang University as another university college? Not two independent universities, to be developed separately in Singapore and the Federation.

THE LECTURER: For some considerable time to come it is desirable to have only one university, one level of academic standards and one degree of authority in the whole country. Therefore I entirely agree with the recommendation of the Commission that that should be the organization envisaged, with separate university colleges for Kuala Lumpur and Singapore. I am afraid I have forgotten whether the Commission actually suggested the incorporation of the Chinese Nanyang University into that structure, but personally I think it would be a very good thing if it were—whether it would be politically possible I should not like to say.

MR. IAN MOK-AI: Would Sir Sydney Caine elaborate on his remark that the students at the University of Malaya are politically shy?

THE LECTURER: Perhaps I did not make myself clear. I said there was a great deal of political interest but that it tended to be concentrated on the one topic of national development, Malayan nationalism; and I myself felt a little disappointed that there was not a wider political interest. Perhaps it was just that at that stage of political development the single big question of attaining self-government dominated anything else, that people could not think of anything else. That is what I meant to emphasize: this highly concentrated interest, the feeling that there should be a single political point of view among students, that they should not have different points of view.

MRS. E. MUNRO RUNTZ: Could Sir Sydney tell us what proportion of students live in hostels and halls of residence?

THE LECTURER: I do not know the latest figures. At the time I was there about two-thirds lived in hostels and halls of residence. Mostly these were the students who came from outside Singapore, plus a rather small number of those whose homes were in Singapore.

MR. MOHAMED SOPIEE (Malaya House): In a recent series of articles in the Chinese language Press in Malaya it was stated that the cost of education in the University of Malaya was very much higher than that in other universities in Asia. Perhaps one of the reasons for this is that the cost is linked with academic standards. Will the lecturer comment on that?

THE LECTURER: I think it is true that the cost of the university per student is higher than that of the great majority of universities in Asia. That is the consequence of adopting the same kind of policy as pursued by universities in this country—a very high proportion of teachers per student. In the University of Malaya there was approximately one teacher for every ten students. In comparison, at one time the University of Bangkok had one teacher per forty students. We hope the greater number of students does mean a higher standard. It also means a greater amount of research activity, which ought to be included in the probable product which is being paid for.

THE CHAIRMAN: Sir Sydney mentioned the question of languages in the university picture. As we know, the university at present is a joint institution, supported financially by both the Singapore and the Federation Governments. But for the information of our audience this evening, I should like to say that as far as the Federation of Malaya is concerned, because of our desire to create national unity

through the medium of our educational institutions, we have adopted a new educational policy. I do not want to take time in explaining the policy, but one of its main principles is to impart the knowledge of Malay to the population as a whole so that the Malay language will be the national language of the Federation of Malaya. We hope to impart this knowledge of Malay to all children of every race. When they go to their primary schools they will all start learning Malay. At the same time, however, we are also committed in the policy to foster the development of the cultures and languages of the other races, the Chinese and the Tamil. Also, because we recognize that for many many years to come our people will not be able to proceed abroad for higher studies without a knowledge of English, we are still continuing, of course, to teach English in the secondary schools. Although I hope that eventually Malay will be the medium of teaching in our higher educational institutions, such as the university colleges, I think that English will continue to be the medium of instruction for very many years to come.

On behalf of the audience to-day I should like to thank Sir Sydney Caine for a most interesting lecture and for his readiness to answer the various questions.

The vote of thanks to the Lecturer was carried with acclamation.

SIR SELWYN SELWYN-CLARKE: It is my privilege and pleasure to propose a vote of thanks to our Chairman. We have not had the pleasure of seeing him in this hall before, but he is very much at home in this part of London, for he was called to the Bar at Lincoln's Inn at the age of 21. (It took me nearly double that time before I was called to the Bar, in 1929!) Dato Nik Kamil was mainly responsible for the motto which has been adopted by the Federation of Malaya, 'Unity is Strength'; and he was also, I believe, responsible for its flag. Since he was appointed as High Commissioner of the Federation of Malaya to this country in August of last year he has endeared himself to everyone with whom he has come in contact, and I think from the way in which he has conducted our proceedings to-day it is easy to understand why. We are most grateful to him for sparing the time to come.

The vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.

GENERAL NOTES

SOME LONDON EXHIBITIONS

Fellows of this Society have doubtless come to welcome the reorganization of the *Journal* as a substantial monthly periodical. For the reviewer of art exhibitions, the change naturally requires some change of approach, for a show in a dealer's gallery seldom over-runs a period of three weeks. Thus the Redfern Gallery's religious anthology entitled *The Christian Vision* is due to close on 26th April, unless the public response to its theme should demand a slight extension. In the case of exhibitions of longer duration, such as the Oppé collection of English water-colours and Old Master drawings which will continue to draw crowds to the Royal Academy until 1st June, the reviewer is enabled to offer his after-thoughts rather than first impressions of what has already been widely noticed.

Nothing, one might reflect at Burlington House, quite matches the passionate pride of a collector poring, yet again, over his portfolio of prints, or his sheaves of mounted drawings, every one representing a find and recalling a circumstance, an artful stratagem, maybe, which put a rival off the scent. At the beginning of this century, early English water-colours and bundles of barely examined prints and drawings on outdoor trays provided a collector's paradise. The late Frank Emanuel, that untiring topographical draughtsman and authority on Charles Keene, and Mr. Thomas Girtin, descendant of the great water-colourist, have been among the

most perceptive fanciers in this field. Another, and more ambitious, was Paul Oppé, a connoisseur of quite exceptional scholarship and persistence, who assembled more than two thousand water-colours and drawings in his house in Cheyne Walk, Chelsea.

'A battered portfolio on a green baize table had an irresistible fascination for him', Sir Kenneth Clark recalls in his foreword to the catalogue of the Oppé collection; 'and it is easy to picture his dark, Disraelian head bending intently over a bundle of drawings, till a sardonic smile indicated that some rarity had escaped the auctioneer's attention.' Oppé's early enthusiasm for the Italian school is revealed, at the Diploma Galleries, in his drawings by the Carracci among other series, and in such individual gems as the sleeping baby attributed to Veronese (was ever plump, creased flesh so completely realized in chalk?) and a water-colour of a drake by Raphael's assistant, Giovanni da Udine. The scholar's curiosity was thus led to the English artists of the eighteenth century, notably Richard Wilson and John Downman, who were inspired by the Italian scene.

Oppé's original research in this field was invaluable. He it was who demolished such legends as that his cherished blot-master, Alexander Cozens, was the natural son of Peter the Great and a Deptford woman; while his eagle eye which fastened on the water-colour masters—Cozens, Towne, Girtin, Turner, Constable, at their freshest—alighted on the unfamiliar with no less relish. An astonishing accumulation indeed, around which you move at a snail's pace.

In contrast to this scholarly collection, the assortment of religious pictures, sculpture, and stained glass—old and new—gathered at the Redfern Gallery under the title *The Christian Vision* is arbitrary almost to the point of eccentricity. A fine wooden Calvary group of the fifteenth century confronts a spiritless copy of Leonardo's *Last Supper*, apparently a student work of Mr. Gerald Brockhurst's, while Mr. Stanley Spencer's curiously compelling *Baptism of Christ* is surrounded by the oddest jumble of period styles. Nevertheless, the exalted drama of the Gospel narrative cannot fail to make an impression on the spectator, and the very arbitrariness of the selection quickens curiosity.

Among the images that stay most vividly in the memory are the sombre and intensely felt Miserere prints of Georges Rouault, the clawing forms of Mr. Sutherland's *Deposition*, and a grotesque, yet also momentous vision of *The Entry into Jerusalem* by that uncomfortable illustrator, Mr. Edward Burra. This Christian anthology, incidentally, anticipates what may well be a more consistent one planned by the Contemporary Art Society, mentioned in a review of Mr. Godfrey's book elsewhere in this issue.

At the time of writing there has just opened another exhibition of especial interest to us who belong to a Society dedicated equally to the Arts and Science. Joseph Wright of Derby, who was the first professional painter to express the thrill of scientific exploration which spurred the Industrial Revolution was, one may surmise, a painter after the Prince Consort's heart. Wright exhibited with the Society of Artists from 1765, and later at the Royal Academy he was among the most conspicuous of the provincial contributors, being elected an Associate in 1781, but quarrelling with the Academy a few years later.

The collection of thirty-four of Wright's paintings and some drawings, brought by the Arts Council to the Tate Gallery and carefully catalogued by the selector, Mr. Benedict Nicolson, shows the range of this Midland little master, the exact coeval of Romney. In Wright's best known subject-pictures, his first concern was with the Caravaggesque effects of light, whether in the glare of the forge, or illuminating the watchers intently encircling, and sometimes masking, a demonstrator's lamp. It is, too, such freaks of illumination that enforce the dramatic intensity of his outdoor scenes, under moonlight, or the rainbow's arc, or a golden hail of fireworks in Rome.

In certain respects, especially in the candour of his portraiture and occasionally

in a quaint little figure in a landscape composition, Wright may recall that greater provincial, George Stubbs. The clear-eyed honesty of the Derby painter is as evident, indeed, in his portrait of his friend Arkwright, cotton-spinning invention at hand, as in that celebrated presentment of Sir Brooke Boothby, elegantly attired, gloved, and recumbent in an attitude of complacent meditation in a glade, which likewise discloses a certain humorous relish. Besides his portraiture, there are assembled a number of the artist's neo-classical and romantic extravaganzas, characteristic of the period, including his mysterious cavern scenes. But it is to Wright's heightened interpretations of his industrial society that one always returns, informed as these are by the most delicate refinement of feeling and touch.

NEVILE WALLIS

THE ROYAL DRAWING SOCIETY'S ANNUAL EXHIBITION

The Royal Drawing Society's 63rd annual exhibition of children's pictures—popularly known as 'The Children's Royal Academy'—will be held at the Guildhall Art Gallery from 26th April to 10th May. Amongst the two hundred works on view will be a very colourful picture by W. Jinasena, aged 17, of the Central School, Weeraketiya, Ceylon, entitled *At Work*, which has been awarded the Royal Society of Arts Bronze Medal.

This award most appropriately marks the revival of an old association. The formation of The Royal Drawing Society was in large measure due to the interest aroused by a paper on 'Drawing, A Means of Education', read to this Society by Mr. T. R. Ablett in May, 1888; and in the following years the offer of Bronze Medals by the Society of Arts did much to promote the success of the earliest competitions in schools organized by the Royal Drawing Society. In the summer of 1957 (see *Journal*, 5th July, p. 632) the Council gladly agreed to a suggestion by Mr. R. R. Tomlinson, President of the Royal Drawing Society, that this practice should be resumed.

There is no charge for admission to 'The Children's Royal Academy, 1958', which will visit Hove (Art Gallery, 19th July—17th August), Portsmouth (Cumberland Art Gallery, 21st September—14th October) and Gateshead (Shipley Art Gallery, 28th October—28th November) after leaving London.

RESIDENTIAL COURSE ON 'THE LUNAR SOCIETY'

The University of Nottingham Department of Extra-Mural Studies, in association with the Extra-Mural Department of the University of Birmingham, announces a residential summer course on 'The Lunar Society: Science and Thought in the Eighteenth Century', to be held at Soho House, Birmingham, from 23rd to 31st August. There will be several visiting lecturers, experts in particular subjects, and a library of contemporary material will be assembled for those attending the course who wish to undertake original inquiries. Particulars of the syllabus and cost should be obtained from J. T. Rhodes, Course Secretary, 14–22 Shakespeare Street, Nottingham, as soon as possible. The closing date for applications is 30th June.

The Lunar Society (which derived its name from a custom of meeting at the full moon to ease members' difficulties in returning home) was one of the chief centres of progressive thought in the later eighteenth century, especially in respect of the sciences. It had affinities and (through members common to both Societies) many points of contact with the Society of Arts. An article examining this relationship will form one in a series devoted to this Society's archives which will shortly begin to appear in the *Journal*.

TRAVEL GRANTS IN THE FIELD OF THE ARTS

The English-Speaking Union announces the offer of four Travel Grants to the United States, for which application may be made by men and women between

30 and 50 years of age who are experienced in a branch of the arts such as painting, sculpture, music, architecture or design. Museum curators and art historians are also eligible.

Each Grant will cover the cost of travel to and from the United States and travel within that country. There will also be a subsistence allowance for each day spent in the United States, up to a maximum of 70 days (which is the recommended length of the visit). The Grant may be taken up any time after mid-September, 1958, but it must be completed by 30th June, 1959. The closing date for applications is 7th June, 1958.

Further particulars and application forms may be obtained from The Secretary, The English-Speaking Union, 37 Charles Street, London, W.1.

STUDENTSHIP FOR RESEARCH INTO TRANSPORT

Applications are invited for a Rees Jeffreys Studentship, tenable at the London School of Economics, to enable a suitable candidate to devote at least one whole year to full-time research into the Economics of Transport. The Studentship is not confined to university graduates, but is also open to any person who has been engaged in the administration of transport, including that by road, or in the production of transport equipment or facilities. The value of the Studentship will be £500, and it will be tenable from 1st October, 1958. Applications must be received not later than 1st September, 1958.

Full particulars and application forms may be had of The Registrar, The London School of Economics and Political Science, Houghton Street, London, W.C.2.

OBITUARY

We record with regret the deaths of a former Member of Council and two Fellows of the Society.

SIR JAMES SWINBURNE

Sir James Swinburne, Bt., F.R.S., an erstwhile Member of Council and Vice-President of the Society, died on 31st March. As noted in the last issue of the *Journal*, he had celebrated the centenary of his birth on 28th February.

The son of Captain T. A. Swinburne, R.N., James Swinburne was born in Inverness and educated at Clifton College. He received his engineering training on Tyneside from 1874–81. As a young man he was associated with Sir Joseph Swan in the development of the carbon incandescent lamp, both in this country and on the Continent, and later became Technical Manager and Designer to Crompton Ltd. Deciding to practice in a wider sphere, in 1894 he settled in London as a consulting engineer, and soon won wide recognition and success. He served as President of the Institution of Electrical Engineers in 1902–3. In 1906 he was elected a Fellow of the Royal Society.

Swinburne had an understanding of the needs of the electrical industry, then in its adolescence, which was decidedly advanced for the time. In particular, his appreciation of the lack of reliable insulating materials led him on to work in the chemical field which, through a study of the properties of resins then generally neglected, resulted in a pioneering contribution to the discovery of plastics. He established his own laboratory in 1904, and eventually developed a process for the condensation of phenol and formaldehyde. In the patenting of this discovery he appears to have been just anticipated by Dr. Baekeland, whose work has perhaps received a larger share of publicity than Swinburne's. It should be remembered, however, that Swinburne achieved this success independently, and that thereafter he continued to follow his own course, concentrating upon the production of lacquers and impregnated compositions. To manufacture these he founded his own company, Damard Lacquer

Ltd., in Birmingham in 1910. During the 1914–18 War this firm had the use of Dr. Baekeland's patents, and after the Peace it combined with Mouldensite Ltd. and Redmanol Ltd. to become Bakelite Ltd., of which Swinburne was Chairman until 1948, and thereafter Honorary President. He was President of the Plastics Institute in 1937–8.

Swinburne's remarkable powers were also applied to deep-sea salvage. In 1923–4, together with C. P. Sandberg, he designed an apparatus to be used in recovering the bullion from the ship *Egypt*, which had sunk off Ushant in 1922. Though their invention was never used, the bullion was later salvaged with the aid of a similar machine.

Swinburne described his recreations as music and sociology, and he made thoughtful contributions to each. For many years he was a member of the Royal Music Association and also served on its Council. In 1924 he published a book on *Population and the Social Problem* in which he expounded some unorthodox and challenging views. The quality of his thinking was well demonstrated late in life, in an exposition of *The Mechanism of the Watch*, written in 1950.

Sir James had been a Fellow of this Society for sixty-two years. He was a Member of Council from 1911–15, a Vice-President of the Society from 1921–4, and a Member of Council again from 1927–30. His contributions to the Society's Proceedings were not confined to electrical engineering, though his Cantor lectures, which have already been recalled (p. 377) were delivered with a special authority, and he followed them, in 1899, with a paper on 'Nernst's Electric Light'. Thereafter, whether in the Chair or taking part in discussion, he left his mark on meetings concerned with subjects ranging from the transport of goods in London to the organization of scientific research; from theatre lighting to the reform of the British Patent system. In connection with patents, indeed, he had a reputation as an expert witness in legal cases, always showing in the exposition of complicated technical matters a remarkable lucidity, and making that kind of courteous allowance for the novice which characterized his Juvenile Lecture on 'The Science of Some Toys,' in 1916.

Sir James was the ninth holder of the family baronetcy, an honour which came to him on the death of his cousin, the eighth baronet, in 1934. He is succeeded by his elder son, Mr. S. C. Swinburne.

SIR JOHN CUMMING

Sir John Cumming, K.C.I.E., C.S.I., died in London on 9th March, aged 89.

The son of a doctor, John Ghest Cumming was born on 29th December, 1868, and educated in Glasgow, at the High School and the University. He entered the Indian Civil Service in 1887, and after some years of district and secretarial experience, in 1908 he was placed on special duty for industrial inquiries. In 1909 he was appointed a secretary to the Bengal Government, and in 1913 became its Chief Secretary. Assiduous in his responsibilities, unfailingly patient and courteous, handling a multiplicity of business with despatch and good sense, Cumming was clearly marked out for further advancement. In 1917 he joined the Executive Council of the Governor of Bengal, Lord Ronaldshay. The following years were a period of increasingly difficult financial problems, and they also saw the emergence of a formidable revolutionary movement, and Mahatma Ghandi's first campaign of non-cooperation. In the face of these troubles Cumming proved to be sagacious and dependable, and his premature retirement through ill-health in 1920 was generally regretted. He was made K.C.I.E. in the same year.

Returning to England, Cumming devoted himself to philanthropic and literary work, particularly on behalf of the Royal National Lifeboat Institution, of which he was Vice-President in 1931. From 1926–46 he was Vice-Chairman of the London School of Oriental and African Studies.

As an editor Cumming put his knowledge of Indian affairs to admirable use in three major works: *Modern India* (1931), a survey of the machinery of government; *Political India* (1932), which is a valuable aid to understanding the background of the India Act of 1935; and *Revealing India's Past* (1937), an archæological outline produced under the auspices of the India, Pakistan and Burma Society. His official work in India had also developed in him an interest in criminology and police work, which bore fruit in *The Police Journal*, a professional quarterly for police forces in the Empire which he founded in 1928 and edited until 1930.

Sir John Cumming was elected a Fellow of the Society in 1901. In April, 1946, he took the chair at a meeting of the Dominions and Colonies Section, when Major-General Sir Leonard Rogers read a paper on 'Progress in the Control of Leprosy in the British Empire'.

MR. MICHAEL JOSEPH

Mr. Michael Joseph, the well-known publisher and author, died on 15th March, aged 60.

Born on 26th September, 1896, Joseph was educated at the City of London School and London University. During the First World War he served with the Wiltshire Regiment and in the Machine Gun Corps. From 1926–35 he was a Director of Curtis Brown Ltd., the literary agency, and in the latter year he founded the publishing firm which bears his name. It was a particularly difficult time for launching such an enterprise; many publishing houses were being forced into liquidation; but Joseph clung on, survived and prospered. The titles of some of his own books—*Short Story Writing for Profit*, *The Commercial Side of Literature*, *This Writing Business*—themselves partly suggest why. In addition to being level-headed and resourceful, Joseph had an uncommonly keen sense of what makes a publishable, saleable—and enjoyable—book. His personality and methods won the confidence of authors, for he allowed them to be satisfied only with their best work; with the result that many outstanding names appeared over his imprint. With fiction he was particularly successful, and in this respect he gave the Society his own view of 'The Function of the Publisher' in a Cantor Lecture delivered in May, 1953 (*Journal*, Vol. CI, p. 770). He was elected a Life Fellow of the Society in the following year. Earlier than this, however, he had been associated with the Society in the publishing of three important collections of lectures and papers delivered during the Second World War: *Agriculture To-day and Tomorrow* and *Education To-day and Tomorrow*, both in 1945, and *British Commonwealth Objectives* in 1946.

Joseph gave great pleasure to many people by his books on cats, of whom he was a devoted admirer. In particular, he wrote about his Siamese cat, Charles, with a blend of insight, humour and respect that is not easily forgotten.

CORRESPONDENCE

TRISECTION OF AN ANGLE

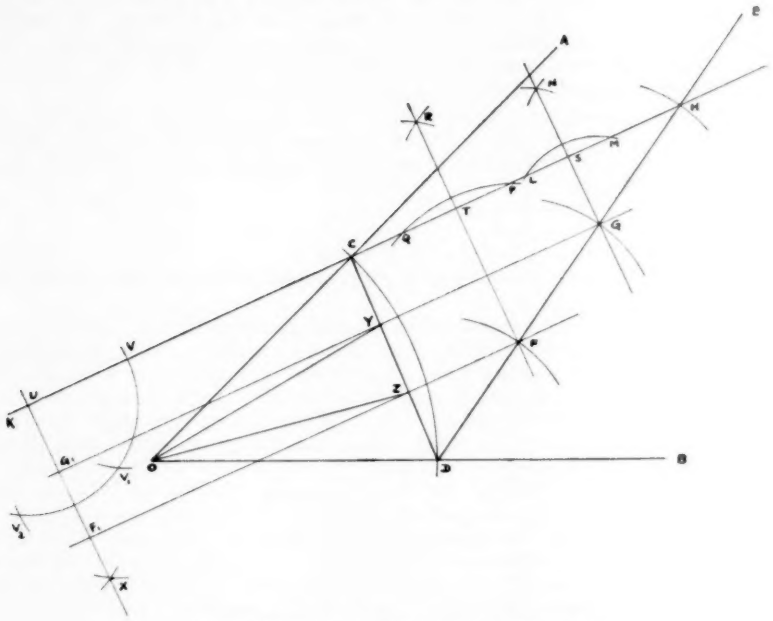
From *Mr. C. E. M. Critchfield, M.I.Mech.E., Flat 54, Stancliffe, 6 Wyargine Street, Balmoral, N.S.W., Australia*

W. W. Sawyer, in his excellent book, *Prelude to Mathematics*, states that for 2,000 years a search has been made for a method of trisecting an angle, using only compasses and ruler. He further states that the problem has been proved to be insoluble.

Since the construction which I submit herewith *does* appear to trisect an angle (using only compasses and ruler), and since it is exceedingly unlikely that I have

succeeded where the sages of two millenniums have failed, it follows that there must be a fallacy somewhere.

The comments of other Fellows might be interesting.



Proposed construction for trisection of an angle

Let AO and BO be two straight lines intersecting at O, and enclosing the angle AOB. It is required to trisect this angle.

METHOD:

With centre O and any convenient radius, strike an arc cutting AO at C and BO at D.
Join CD.
From D draw any straight line DE.
With centre D, and any convenient radius, strike an arc cutting DE at F.
With centre F, and radius DF, strike an arc cutting DE at G.
With centre G, and radius DF, strike an arc cutting DE at H.
Thus, DF = FG = GH.
Join HC and produce to K.
With centre G and any suitable radius, strike an arc cutting HK at L and M.
With L and M as centres and with equal radii, strike a pair of arcs intersecting at N.
Join NG.
Thus: by the geometry of the circle, NG is perpendicular to HK.
By similar construction, draw the line RF which will be perpendicular to HK.
Take any convenient point U on HK, and with centre U strike an arc cutting HK at V.
With centre V and radius UV, strike arcs VV_1 and VV_2
With the same radius, strike a pair of arcs intersecting at X.
Join UX.

With centre U and radius SG, mark off intercept UG_1.
With centre U and radius TF, mark off intercept UF_1.
Join GG_1 and FF_1, cutting CD at Y and Z respectively.
Join OY and OZ.
Now:
CHD, YGD, and ZFD are similar triangles, since HK, GG_1, and FF_1, are all parallel.
DF = FG = GH by construction,
so that
CY = YZ = ZD,
and from the geometry of the circle,
angle COY = angle YOZ = angle ZOD.
In other words, the angle AOB has been trisected.

NOTES ON BOOKS

THE PICTURE HISTORY OF PAINTING. *By H. W. and Dora Jane Janson. London, Thames and Hudson,* 1957. £4 4*s*

CHRIST AND THE APOSTLES. *By F. M. Godfrey. London, The Studio,* 1957. 45*s*

So luxurious a volume as this picture history with its popular and descriptive, though not misleading text, accompanying over five hundred illustrations (a hundred in generally faithful colour) goes far to disarm any adverse criticism that could usefully be levelled. The 'blurb' on the jacket is not exaggerated, though its claim to bring the story up to Abstract Expressionism might very well suggest the spontaneous abstraction which lays emphasis on the creative act, and the exploitation of the actual materials of painting. This movement (sometimes called 'Action painting') which has now assumed the force of a tidal wave in America and the Continent, setting any number of British artists bobbing uncertainly in its wake, is not mentioned by the authors at all. At the same time, the label 'Abstract Expressionism' can also be applied to the pioneering inventions of Wassily Kandinsky, and these, with the Surrealist fantasies of Paul Klee and Joan Miró, are discussed, without cloudiness, in the last pages on this Never-Never land of the artist's unbridled fancy.

Opening with Cave painting and the early Mediterranean cultures, the volume presents in broad outline the history of painting almost exclusively as it has developed in Europe. Each successive style since the Renaissance can be seen as a movement of liberation from some convention, with the example of the past forever serving fresh ends and never rejected so utterly as it was in the first decade of this century. The revolutionary concept of space in the Cubist experiments of Picasso and Braque who discarded the 'window pictures' of the Renaissance, and the aggressive movement of Italian Futurism which extolled speed and the machine, were deliberate rejections of the oppressive weight of the past. This was the most astounding fracture in the underlying continuity of painting for centuries, and the authors seem, for once, to show a lack of proportion in relegating Futurism to two brief captions beneath illustrations, though Cubism, it is fair to say, is dealt with as adequately as a popular exposition allows.

On the whole, the illustrations have been well chosen from a variety of sources, not infrequently from American museums, and the colour, as has been said, is generally true enough, though the blue tends perhaps to be a shade too insistent in one section. In the result, the survey is as appetising an introduction to ordinary readers as care and enthusiasm could contrive.

Mr. Godfrey's book has, perhaps, a weightier claim on the attention of the inquiring layman. Yet it must be confessed that his examination of the artistic and religious significance of his selection of paintings and mosaics produced over a period of twelve centuries, illustrating the life of Christ and the Apostles, though a most

worthy and industrious compilation, never quite grips the imagination. There are, as might be expected, masterpieces among the hundred plates which lift the spirit and set the mind pondering, as in Caravaggio's *Supper at Emmaus*, on the painting's dramatic intensity. But does this National Gallery picture (one of the few, incidentally, reproduced in colour) really require a commentary a little overburdened with epithets? 'The magic of Christ is invested in the light', Mr. Godfrey tells us truly; 'light which blazes from an invisible source upon His brow, His smooth oval face, the beige-coloured mantle and crimson robe. Caravaggio's Saviour with His long ringlets framing His beardless face, the pointed chin, the moist lips, though He is in earnest, will not yield any religious emotion.' There is more in this vein, concluding with a quotation from Bernard Berenson which seems to sum up what has been told so diffusely: for Berenson, the *Supper at Emmaus* represents 'hard-visaged peasants, humping shoulders and arms shot out, who have heard something startling'.

That is not to deny the value of the author's painstaking text to readers who have never previously considered in any detail, as they now may, the changing forms and symbols of religious imagery from the early Christian mosaics to the European Baroque. The discontent that rises in the mind is perhaps rather akin to the recognition that some sculptural work of inspiring theme has been entrusted to a diligent, but uninspiring craftsman. It is not difficult to imagine the intellectual excitement that might have been provoked, let us say, by Sir Kenneth Clark's handling of this tremendous subject. Even so, when Mr. Godfrey's book is closed, the theme itself has set the reader's mind in motion, for the Gospel story has inspired others after Tiepolo, the last of the masters here considered. In our day, Georges Rouault has portrayed the Man of Sorrows with sombre and moving grandeur, and perhaps more of our contemporaries have been stirred by the Life and Passion than we know. We shall see, no doubt, when the Contemporary Art Society presents its eagerly awaited exhibition on the Christian image later on at the Tate Gallery.

NEVILE WALLIS

STATISTICAL THEORY: THE RELATIONSHIP OF PROBABILITY, CREDIBILITY AND ERROR. *By Lancelot Hogben. London, Allen & Unwin*, 1957. 45*s net*

Let it be explained at once that Professor Hogben's latest book is not statistics for the million, nor yet for the citizen. It is, on the contrary, statistics with tears, not least for the statisticians.

When Professor Hogben says he writes as a bioloigst, statisticians will laugh hollowly. Yet there is a sense in which it is strictly true. In this book he is concerned to assert the paramountcy of induction over deduction—to assert the ultimate right of the scientist to overrule the mathematician in any dispute 'about the relevance of the common calculus to the world of experience'. Suppose a hundred people each choose any number between 0 and 9. It might be assumed that every number will be chosen ten times more or less. Testing has shown that 3 and 7 are chosen much more frequently than the other numbers. This very simple example of the difference between deduction and induction has a bearing on the 'crisis' in statistical theory. It casts considerable doubt on the assumption that mental decisions made in complete ignorance are random occurrences.

Research workers rely on statistical theory. They assume that it has been shown to be a logical necessity and that its application to the world of experience has been justified pragmatically. Professor Hogben questions both these assumptions. He points out that there are several statistical theories (in the sense of theories invoking the calculus of probabilities): not all of them can be both right and of universal application unless they can be reconciled. He also points out that the effective application of statistical theory to experimentation shows it has its uses but does not define them.

When statistical theory was first developed, probability 'had as yet no practical interest other than the gains and losses of a dissolute nobility at the gaming table'. One is not entitled to assume that other aspects of the world of experience work like a gaming table—that they have the quality of randomness. In particular, one is not entitled to attribute randomness to some aspect of life merely because one is ignorant of it. One must discover if particular aspects of the world of experience have the quality of randomness. From any that have one should seek to infer criteria by which to recognize others. While one is about it all, one should acknowledge that not even the gaming table works as the classical statisticians postulated. There has never been a perfectly balanced die.

Research workers develop an intuition that often prompts them to reject false results, however respectable the theory on which they rest. Nonetheless Professor Hogben believes 'we can already detect signs of such deterioration in the growing volume of published papers—especially in the domain of animal behaviour—recording so-called significant conclusions which an earlier vintage would have regarded merely as private clues for further exploration'.

At worst statistical methods are baseless. At best they are peculiarly elaborate varieties of scientific method requiring especial care in their application. For both these reasons Professor Hogben urges research workers 'to examine the credentials of principles invoked in the day's work'. Until they have done so, they may like to bear in mind that there is one absolutely safe thing (*a*) to do, (*b*) to say they are doing. It consists in comparing the pattern of figures derived from observation with that of figures derived mathematically, and regarding any similarities or divergences as 'private clues for further exploration'. This can be done 'without recourse to such Platonic constructs as the infinite hypothetical population, the normal man and the normal environment'. No matter how complicated the mathematics involved, it is in principle the same—and will be as inoffensive to a behaviourist like Professor Hogben—as wondering why one of an animal's claws is longer than the others.

STANLEY ALDERSON

PRINTED TEXTILE DESIGN. *By Terence Conran. London, The Studio,* 1957. 25*s net*

This writer has a remarkably lively approach to his profession. He sees his task objectively as infusing a new aesthetic appreciation into an industry which, although possessing the largest fund of technical knowledge in the world, is still hampered by a nineteenth-century attitude to taste. Occasionally Mr. Conran tends to make sweeping statements of the following calibre: 'To a potential customer, particularly a retail customer, design and colouring of a fabric are of primary interest. Quality of cloth is a secondary consideration. . . . ' Immediate appeal is indeed very valuable, but the lack of quality, unless reflected noticeably in the price, will rapidly bring that potential customer to a halt.

Apart from such rather rash generalizations, the book is factual, stimulating and visually well presented—an important factor in a subject of this type, which really demands colour illustration throughout.

The introductory chapters indicate briefly the need for a full understanding of technical processes and all the new synthetic fibres which form the basis of many modern fabrics. To bog himself down in a mass of technicalities, however, is not Mr. Conran's way. He moves lightly over the historical field of his subject, so vast, indeed, that it has to embrace ancient techniques of the Far East as well as the nearer and more familiar methods of Europe.

It is interesting to read that European block printing was at one time restrained by law because block-printed cottons affected trade in the older and more remunerative silken and woollen cloths. But it was the technical invention of the nineteenth century and the development of copper roller printing which helped to create the

industry of textile printing which has its home in Manchester. The very rigidity of roller printing and its enormous cost, however, has favoured the development of screen printing, originally a Japanese method. This is much cheaper and the setting up of a new design far less costly than a new set of copper rollers. Short runs instead of thousands of yards become an economic proposition, and the young artist can experiment himself with screen printing, a fact which, the writer stresses, is vastly important to the would-be textile designer.

Mr. Conran presents the opinions of several outstanding modern designers, introducing them with the remarks of a psychiatrist. He makes a good point in emphasizing the responsibility the artist owes to the community, particularly with regard to the arts which affect the environment of our lives, 'offices, factories, homes and transport'. This gospel, preached since William Morris's day, and its corollary, that the artist must understand not only the techniques of his craft and be alive to the stimuli of modern life, but also understand the business world and sell his work—these are beliefs which give the book its character of alertness and realism.

Mr. Conran's summing up of the commercial world is a reflection of the fears with which the artist all too frequently faces a supposedly hostile public. I think the fears are exaggerated, for the many designers represented in this book have established the value of their work in the business world. Indeed, their reputations are an assurance that artists of knowledge and conviction are an investment all business men would do well to consider.

The grand finale, a copy of a Swedish contract between artist and business man, puts the whole matter in a nut shell. Is there a British equivalent?

SYLVIA POLLAK

THE CENTURY OF THE SURGEON. *By Jurgen Thorwald. London, Thames & Hudson* 1957. 25*s net*

This book is the fruit of a great deal of research, and the errors and discrepancies, which would only be apparent to a life-long surgeon and student of medical history, are extraordinarily few and of no importance. To make the story consecutive, the author makes it appear as the autobiography of the surgeon, Hartmann, born in the year 1824 and living to a prodigious age, so that he saw the unfolding of the surgical drama from the first abdominal operation of Ephraim McDowell in a Kentucky farmhouse, down to the first operation on the heart by Louis Rehn in Frankfurt-on-Main.

The author first suffers from stone, and this takes him to India, the cradle of surgery for stone, and then back to Paris to have one of the earliest operations for this complaint. The visit to India opens the way to the wonderful story of the surgery of nose replacement, starting in India, where this mutilation was the usual punishment for adulterous tendencies.

Then comes the sordid story of the discovery of anæsthesia in Boston, Massachusetts, possibly aided by an early hint from Sir Humphry Davy in 1800. The three men involved in this discovery intrigued, lobbied, bribed and lied against one another in the struggle for priority and monetary gain, and the lives of all three ended in tragedy, two in bizarre suicides and one in the lunatic asylum. What a different tale from the later story of Lister and Pasteur, who remained cordial and friendly, and admired each other's contributions to the relief of mankind, and thought nothing of monetary gain in their desire to help others! If the author had continued his narrative to the present day and dealt with the discovery of penicillin, he would have found the same great altruism in the work of Fleming. The idea of Lister patenting his Carbolic spray, or Fleming his great discovery, never entered into the question.

This really entrancing book carries on from one great discovery to another and

brings in vividly certain famous historical illnesses and operations, such as the appendicitis of Gambetta and Edward VII, and the stabbing of the poor Empress Elizabeth. These accounts are mingled with other operations, historical not because of the patient, but because they were momentous steps in the progress of surgery: the first appendix, the first kidney, and the first stomach removed by men whose names live for evermore in the minds of doctors, but who quite appropriately are forgotten by the general public.

This book is extraordinary in that it is of absorbing interest to the general reader and yet accurate enough to be a book of references for the medical historian.

A. DICKSON WRIGHT

ELECTRICITY IN BUILDING. *By A. L. Osborne. London, Batsford,* 1957. *25s net*

A characteristic of modern buildings is the increasing complexity of the services and the innumerable regulations which govern them. No one man can be expected to be an expert on all these, so specialists have to be consulted and their work co-ordinated, and intelligent co-operation becomes so much easier if all have a broad but accurate knowledge of each other's problems.

The author, himself an architect, with the responsibility of co-ordinating the efforts of many trades, is convinced that whilst electricity is dominating the present age, few know enough about it to ensure that the maximum use is made of its possibilities. In writing this lively book, he has produced something which is of value not only to all those whose work is directly concerned with building, but which also has an appeal to individuals who like to acquire a reasonable knowledge of their environment.

The book is eminently readable and a masterpiece of compression, covering within its 160 pages the theory of electricity, the method of its distribution over the country, the principles and practice of installation, and specialist chapters on lighting, space heating and water heating.

Whilst it does not claim to be a text book, each aspect is dealt with much more fully than one would describe as normal general knowledge. To appreciate it fully, particularly some of the theory, a basic knowledge of electricity and magnetism is necessary, but even without this, the non-technical reader can both enjoy and profit from it. Particular emphasis has been given to the domestic installation, 'because it is familiar and close at hand and provides numerous convenient pegs on which to hang explanations and to display various techniques'.

The installation section deals with all aspects from the main intake to the bathroom light, and the various types of wiring are fully described. The need for good workmanship and the logic which is behind the safety regulations are clearly brought out, two aspects which cannot be too often stressed in these days of so much 'do it yourself'.

That electricity should be used for lighting is taken for granted, but the author has been impressed—and presumably shocked—by the number of low standard installations which ignore the great possibilities of modern lighting techniques and apparatus. The author regards lighting as so important that a long chapter gives all the principles of illuminating engineering, and particular reference is made to the fact that comfort has an aesthetic as well as a scientific content.

Both the theory and practice of space heating and water heating are described, the various types of heating being compared and data given for calculating the load.

The numerous illustrations are a great help to the reader and in the majority of cases are adjacent to the text which refers to them—a great convenience. The photographs have been carefully selected, but the author, taking full advantage of his skill in making line drawings, has been able to illustrate exactly what he wanted as many times as he wished.

The book concludes with several appendices—on tariffs, power factor, graphical symbols, special services, a list of relevant B.S. numbers and codes of practice. The last two in particular should be a handy *aide-mémoire* for those who need to refer only spasmodically to the documents.

A comprehensive index completes a slim volume which is packed with information.

D. W. DURRANT

SYDNEY'S GREAT EXPERIMENT. *The Progress of the Cumberland County Plan. By Denis Winston. London, Angus and Robertson,* 1957. 37*s* 6*d net*

Australia, peopled by English-speaking stock at the far end of the earth and acutely aware of the pressure from Asia, has a population of less than ten millions on an area thirty times as great as the United Kingdom. It has had planning control for over thirty years, and its legislation now broadly resembles the British Act of 1932, with its restrictive background. An inquisitive person might ask whether legislation, now thought an anachronism in the old country, is in tune with the rapid developments taking place in the new, and whether the tortuous process of producing plans to control development stemming from the ebb and flow of private demand is enough.

Professor Winston, a leading Planner in Australia, was commissioned by the Cumberland County Council to produce a book describing their Plan and its objectives; but at the same time he has not shirked the job of assessing its worth, which he does with discretion and adroitness.

An important generalization was stated in the *Economic Journal* in 1935: that towns and villages tend to be dispersed in a pattern generally capable of mathematical analysis. Australia is an exception to the rule. There, the population of the County of Cumberland (about 1,700,000 in 1947) has already grown to 2,000,000 (or about one-fifth of the country's total population) and all but a few of these live in Sydney itself.

The County Council, created under an Act of 1945, was charged with the duty of preparing a planning scheme within three years. They met with a lot of opposition, mostly from their 41 constituent authorities, and there was a delay of three years in securing Government's approval. Professor Winston regards this delay as a great setback to the scheme, especially as considerable building development took place in the meantime on the proposed green belt and open spaces.

The problems of congestion and dispersal have so far hardly been grappled with, and the attractions of life in Sydney may lead to overcrowding in the town and a socially derelict hinterland. If further development of the fringes of Sydney is to be arrested, provision must be made for development beyond the green belt, and the County Council may be criticized that neither in their scheme, nor since, have they made any clear proposals to that end. The needs of the city's rapidly increasing population will not evaporate by girdling it with a belt, and any limitation presupposes a policy for the development of areas beyond the belt. Towns such as Penrith, Campbelltown, Blacktown and Windsor have been mentioned as places for expansion and the hope expressed that some will become important industrial centres, but further action is left to the district authorities. The rural zone which the plan includes seems to be similar to those which planning authorities in Britain introduced before the War and which were only partially effective in stopping urban sprawl.

Readers outside Australia will appreciate that the Cumberland County Council is not comparable with an English County Council but is an *ad hoc* body set up to prepare planning schemes, and consists of representatives from constituent municipalities and shire councils. The idea of a regional authority is something which other countries could usefully examine, but the Cumberland County Council's responsibilities stop short of carrying out public works or of financing them. It ought to be given the means to see at least its basic proposals implemented. But a start has

been made and here is one of the world's great cities and a rapidly-growing metropolitan region being dealt with as a unit for planning purposes.

The volume is well illustrated and ought to evoke the wide interest not only of those living in the region, but also of all who are interested in the first steps towards improving the relationship between homes and work-places and the co-ordination of development in a very important country in the Commonwealth.

AYLMER COATES

SHORT NOTES ON OTHER BOOKS

ART TREASURES OF THE BRITISH MUSEUM. *Chosen and introduced by Geoffrey Grigson and photographed by Edwin Smith. With* 153 *Plates in Photogravure and* 6 *Plates in Colour. Preface by Sir Thomas Kendrick. London, Thames & Hudson,* 1957. *£3 3s net*

Mr. Grigson has selected objects to represent 'the spirit of the Museum'. 'Most of them are sculpture . . . and more than half of them represent, or have to do with, the gods and religious beliefs or practices of mankind, or were produced in eras of religious thinking or feeling.' There are notes on each of the handsomely produced plates.

WATERCOLOUR—A CHALLENGE. *By Leonard Brooks. New York, Reinhold (London, Chapman & Hall),* 1957. *£5 net*

Addressed to the enthusiast—whether amateur or hard-working student—this book is an attempt to bridge the gap between the purely technical and elementary approaches to the subject with some of the creative processes which underly all creative art. New and old methods in the use of watercolour and casein are discussed and demonstrated (by means of the author's own paintings), but it is stressed that technique is only part of a larger vocabulary which the painter must master.

CITADEL, MARKET AND ALTAR: EMERGING SOCIETY. *By Spencer Heath. Baltimore, Md., The Science of Society Foundation, Inc.,* 1957. $6

Described as an 'Outline of Socionomy, the New Natural Science of Society', Mr. Heath's book is concerned with those forms of human organization 'which unleash creativity in its widest aspects'. It points out the operation in modern society of a universal law whereby free enterprise technology will ultimately provide public as well as private services at a profit, through free contractual engagements.

THE SCALLOP: STUDIES OF A SHELL AND ITS INFLUENCES ON MANKIND. *By eight authors. edited by Ian Cox. London, Shell Transport and Trading Co. Ltd.,* 1957. *14s 3d*

Here are considered some of the lesser-known aspects of the story of the scallop shell, including its uses in ancient times, as a symbol in heraldry, art and architecture and its associations as a badge of pilgrimage. A final chapter brings the scallop to the table. Amongst the contributors are Sir George Bellew, Adrian Digby, Christopher Hohler, James Laver and Sir Mortimer Wheeler. The volume commemorates the Diamond Jubilee of the Shell Transport and Trading Co. Ltd.

ORIGIN OF THE SOLAR SYSTEM. *By A. W. Titherley. Winchester, Warren & Sons Ltd., The Wykeham Press,* 1957. *21s*

Dr. Titherley postulates a theory that the solar system originated from the Sun by a series of rapid thermo-nuclear explosions which expelled successive clouds of

incandescent gases, chiefly hydrogen; each a potential planet. The solidified drops of mineral matter that separated on cooling eventually became consolidated by gravitational accretion, and after travelling great distances, formed the planets, which returned towards the Sun by long spiral paths, ending in their present elliptical orbits.

FROM THE JOURNAL OF 1858

VOLUME VI. *14th May*, 1858

EXAMINATION PROCEDURE

From the Secretary's Letter of Instructions to the Local Boards:

The Time-table has been drawn up to meet the general convenience of the whole number of Candidates who will meet at the different centres. If any one, among those who are examined under your superintendence, wishes to work *two* Papers which are fixed for the *same hour*, he should be strongly recommended to confine himself to *one* of them; and to bear in mind that, while one high certificate is of more value than two low ones, he will have an opportunity, next year, of being examined in the subject which he omits on the present occasion.

The Candidates should sit, in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well, when two or more papers are worked at the same time, to arrange alternately the Candidates who take different subjects.

Three hours only are allowed for each paper, except in the case of the exercises in Drawing, for which four hours may be taken.

All writing must cease at the end of the three hours, *to a moment*; and, if there is no clock in the room, it may be well to give notice to the Candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The Candidates should leave their answers at their seats (with the Examination papers attached to them) and have carefully filed them all together in order through the upper left-hand corner. A supply of green silk twist and some large needles should be procured for this purpose.

Some Activities of Other Societies and Organizations

MEETINGS

MON. 12 MAY. Geographical Society, Royal, 1 Kensington Gore, S.W.7. 5 p.m. J. P. Gerasimov: *Land use and contemporary geography in the U.S.S.R.*

MON. 19 MAY, Geographical Society, Royal, 1 Kensington Gore, S.W.7. 5.30 p.m. Colour film: *Persian journeys.*

WED. 21 MAY. Radio Engineers, British Institution of, at London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. 6.30 p.m. J. H. Beesley: *Cold-cathode voltage transfer circuits.*

THURS. 22 MAY. University College, London, at Chemistry Theatre, Gower Street, W.C.1. 5.30 p.m. Dr. D. McKie: *Science and history.*

WED. 28 MAY. University of London, at 20 Portman Square, W.1. 5.30 p.m. Professor Géza de Francovich: *Romanesque wooden sculpture in Italy.*

WED. 28 MAY AND THURS. 29 MAY. Physical Society, at Royal Radar Establishment, Malvern. Conference: *Spectroscopy of solids.*

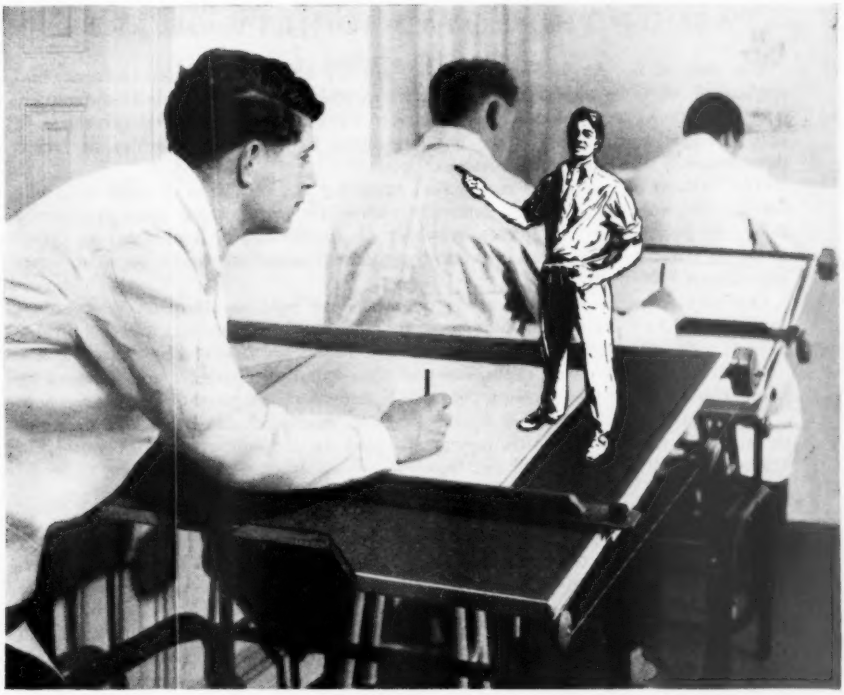
THURS. 29 MAY. Royal Society, Burlington House, W.1. 4.30 p.m. Group-Captain W. K. Stewart: *The Institute of Aviation Medicine.*

THURS. 12 JUNE. Royal Society, Burlington House, W.1. 4.30 p.m. The Bakerian Lecture. M. Ryle: *The nature of the cosmic radio sources.*

TUES. 17 JUNE. Architects, Royal Institute of British, 66 Portland Place, W.1. 6 p.m. Eric L. Bird: *The problem of technical information.*

OTHER ACTIVITIES

NOW UNTIL SAT. 31 MAY. National Book League, 7 Albemarle Street, W.1. Mon.-Fri. 11-6.30; Thurs. 11-8; Sats. 11-5. Exhibition: *Fine books from famous houses.*



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ABOUT THE ROYAL SOCIETY OF ARTS

The aims of the Royal Society of Arts are the advancement, development, and application of every department of Science in connection with Arts, Manufactures, and Commerce. It serves as a liaison between the various practical arts and sciences, and provides a medium for the announcement by leading authorities of recent developments of more than specialized interest.

The Society also exists as a potential agent for the inception of tasks of public service which do not fall very definitely within the scope of any more specialized body. Its function in such cases, however, is purely that of a pioneer, its policy being to hand over schemes requiring permanent superintendence to some other appropriate institution.

Ordinary Meetings for the reading of papers are held regularly on Wednesdays from November to May. A wide range of subjects—artistic, scientific, and technical—is dealt with in the course of each session. The papers are followed by a discussion.

Courses of Lectures of an expository and semi-technical character are delivered on Mondays. Normally, three courses of three lectures each are given during the Session.

Commonwealth Section. The Commonwealth Section holds some ten meetings during each Session at which papers are read on subjects covering a variety of Commonwealth problems and development.

The Society's Journal is sent free to Fellows monthly.

Royal Designers for Industry. The Society in 1936 caused the establishment of an exclusive distinction known as 'Royal Designer for Industry' ('Designer for Industry of the Royal Society of Arts'), and designated by the letters R.D.I. This honour, conferred by the Council of the Society, is limited to forty designers, and is recognized as the highest distinction to be obtained in the field of industrial art.

Commercial Examination. The Society was the originator of commercial and technological examinations in this country, and still holds a foremost position in connection with the former, which, instituted in 1856, are now held four times a year throughout the British Isles, and at specially approved centres abroad, mainly in commercial subjects and foreign languages.

Industrial Art Bursaries. An annual Competition is held for the award of Bursaries to enable young British designers to travel abroad in order to study foreign design at first hand.

Improvement of Navigation. To assist the Science of Navigation and to promote the educational interests of the British Merchant Navy, the Council offers annual prizes, and makes numerous awards, under the Thomas Gray Memorial Trust.

Fellowship. The privileges enjoyed by Fellows of the Society include the receipt of the *Journal*, the use of the Society's House, the loan of books from the Library, the right of attending all Meetings and Lectures, and of taking part in the government of the Society. Fellows may also introduce visitors to meetings of the Society.

Candidates for election to Fellowship of the Society must ordinarily be proposed by three Fellows, one of whom, at least, must sign on personal knowledge. The annual subscription is Four Guineas; or a life composition of Forty Guineas may be paid. There is a registration fee of Two Guineas.

Associate Membership is open, under the same conditions of election as for Fellows, to persons not over the age of 21. The annual subscription is One Guinea, and there is no registration fee.

Associated Institutions. Schools, colleges, libraries, literary and scientific institutions or any other organization whose primary object is the promotion of arts, manufactures, and commerce, may be admitted into union with the Society. Such institutions enjoy most of the privileges of individual membership, including the receipt of the Society's monthly *Journal*, and the right, through an official representative, to attend lectures and to borrow books from the Library. The subscription for this class of membership is Three Guineas without registration fee.

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Address .....

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Rank, Profession or Business .....

I desire to become a Fellow/an Associate Member of the Royal Society of Arts.

Signature of Candidate .....

Date of Birth .....

We hereby propose and recommend the above Candidate as a fit and proper person to become a Fellow/an Associate Member of the Royal Society for the Encouragement of Arts, Manufactures and Commerce.

Signatures of three Fellows, at least one of whom must sign on personal knowledge:

Name in Block Capitals	Signature
[.....]	..... (*on personal knowledge*)
[.....]	.....
[.....]	.....

Read and suspended ..... Elected .....

Details of Candidate's past and present occupation, academic and professional qualifications (in the case of degrees the conferring University should be stated) and any other relevant information should be mentioned overleaf.

Details of Candidate's past and present occupation, academic and professional qualifications (in the case of degrees the conferring University should be stated) and any other relevant information :